OMRON

EJ1
Modular Temperature Controllers

User's Manual

Cat. No. H142-E1-04

EJ1
Modular Temperature Controllers

User's Manual

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Preface

This manual describes the EJ1 Modular Temperature Controllers, including information on functions, performances, and application methods.

Observe the following precautions when using an EJ1 Modular Temperature Controller.

- Do not allow the Temperature Controller to be handled by anyone except a specialist with sufficient knowledge of electrical systems.
- Read this manual thoroughly and be sure you understand it before attempting to use the Temperature Controller and use the Temperature Controller correctly according to the information provided.
- Keep this manual in a safe place for easy reference.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

■ Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the product.

The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.

The following notation is used.

⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, is likely to result in minor or moderate injury or in property damage.

■ Symbols

Symbol		Meaning
Caution		**General Caution** Indicates non-specific general cautions, warnings, and dangers.
		Electrical Shock Caution Indicates possibility of electric shock under specific conditions.
Prohibition		**General Prohibition** Indicates non-specific general prohibitions.
Mandatory Caution		**General Caution** Indicates non-specific general cautions, warnings, and dangers.

■ Safety Precautions

⚠ CAUTION	
Do not touch the terminals while power is being supplied. Doing so may occasionally result in minor injury due to electric shock.	
Use a power supply that complies with the reinforced insulation specified in IEC 60664 for the EJ1 external power supply or the power supply connected to the EJ1. If non-compliant power supplies are used, electric shock may occasionally result in minor injury.	
Do not allow pieces of metal, wire clippings, or fine metallic shavings or filings from installation to enter the product. Doing so may occasionally result in electric shock, fire, or malfunction.	
Do not use the product where subject to flammable or explosive gas. Otherwise, minor injury from explosion may occasionally occur.	
Never disassemble, modify, or repair the product or touch any of the internal parts. Minor electric shock, fire, or malfunction may occasionally occur.	
Tighten the terminal screws to between 0.40 and 0.56 N·m. Loose screws may occasionally result in fire.	
Set the parameters of the product so that they are suitable for the system being controlled. If they are not suitable, unexpected operation may occasionally result in property damage or accidents.	
A malfunction in the product may occasionally make control operations impossible or prevent alarm outputs, resulting in property damage. To maintain safety in the event of malfunction of the product, take appropriate safety measures, such as installing a monitoring device on a separate line.	

Precautions for Safe Use

Be sure to observe the following precautions to prevent operation failure, malfunction, or adverse affects on the performance and functions of the product. Not doing so may occasionally result in unexpected events.

1) The product is designed for indoor use only. Do not use the product outdoors or in any of the following locations.
   - Places directly subject to heat radiated from heating equipment
   - Places subject to splashing liquid or oil atmosphere
   - Places subject to direct sunlight
   - Places subject to dust or corrosive gas (in particular, sulfide gas or ammonia gas)
   - Places subject to intense temperature change
   - Places subject to icing or condensation
   - Places subject to vibration or strong shocks
2) Use and store the product within the rated ambient temperature and humidity ranges.
   Mounting two or more Temperature Controllers side by side, or mounting Temperature Controllers above each other may cause heat to build up inside the Temperature Controllers, which will shorten their service life. If the Temperature Controllers are mounted above each other or side by side, use forced cooling by fans or other means of air ventilation to cool down the Temperature Controllers.
3) To allow heat to escape, do not block the area around the product. Do not block the ventilation holes on the product.
4) Be sure to wire properly with correct polarity of terminals.
5) Use specified size (M3, width 5.8 mm or less) crimped terminals for wiring. Use a gage of AWG22 to AWG14 (equal to cross-sectional area of 0.326 to 2.081 mm^2) for power supply lines and a gage of AWG28 to AWG16 (equal to cross-sectional area of 0.081 to 1.309 mm^2) for all other lines. (The stripping length is 6 to 8 mm.) Up to two wires of same size and type, or two crimped terminals can be inserted into a single terminal.
6) Do not wire terminals that do not have an identified use.
7) To reduce inductive noise, keep the wiring for the product's terminal block away from power cables carrying high voltages or large currents. Also, do not wire power lines together with or parallel to product wiring. Using shielded cables and using separate conduits or ducts is recommended.
   Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular, motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component).
   When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the product.
   Allow as much space as possible between the product and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.
8) Use the product within the rated load and power supply.
9) Make sure that the rated voltage is attained within two seconds of turning ON the power using a switch or relay contact. If the voltage is applied gradually, the power may not be reset or output malfunctions may occur.
10) Make sure that the product has 30 minutes or more to warm up after turning ON the power before starting actual control operations to ensure the correct temperature display.
11) The switch or circuit breaker must be within easy reach of the operator, and must be marked as a disconnecting means for this unit.
12) Do not use paint thinner or similar chemical to clean with. Use standard grade alcohol.
13) Design the system (e.g., the control panel) allowing leeway for the delay required before product outputs are valid after turning ON power to the product.
14) Never touch the electronic components, connectors, or patterns on product boards with your bare hands. Always hold the product by the case. Inappropriately handling the product may occasionally damage internal components due to static electricity.

15) Use a switch, relay, or other device with contacts to turn OFF the power supply quickly. Gradually lowering the voltage of the power supply may result in incorrect outputs or memory errors.
16) Do not touch the electronic components with your hands or subject them to shock when removing the terminal block.
17) Connect only the specified number of products in only a specified configuration.
18) Mount the product to a DIN Rail mounted vertically to the ground.
19) Always turn OFF the power supply before wiring the product, replacing the product, or changing the product configuration.
20) Attach the enclosed cover seal to the connector opening on the left end Unit during installation.
21) Do not use port B on the End Unit when using port C on the HFU.

Precautions for Correct Use

● Installation

1) Do not connect an End Unit directly to an HFU.
2) Always connect an End Unit to the right side of the Basic Units.
3) Always connect the HFU to the left side of the Basic Units.
4) The EJ1 cannot be used linked to a CJ-series PLC.
5) Use the EJ1G-□□ for gradient temperature control. Use the EJ1N-□□ for any other type of temperature control.
6) When removing the terminal block to replace the Unit, be sure to confirm that the new Unit is the same as the Unit that is being replaced.

● Service Life

1) Use the product within the following temperature and humidity ranges.
   Temperature: −10 to 55°C (with no icing or condensation)
   Humidity: 25% to 85%
   When the Temperature Controller is incorporated in a control panel, make sure that the controller's ambient temperature and not the panel's ambient temperature does not exceed 55°C.
2) The service life of electronic devices like the Temperature Controller is determined by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature, the shorter the service life and the lower the temperature, the longer the service life. Therefore, the service life can be extended by lowering the temperature of the Temperature Controller.
3) Mounting two or more Temperature Controllers side by side, or mounting Temperature Controllers above each other may cause heat to build up inside the Temperature Controllers, which will shorten their service life. If the Temperature Controllers are mounted above each other or side by side, use forced cooling by fans or other means of air ventilation to cool down the Temperature Controllers. However, be sure not to cool only the terminals. Doing so will result in measurement errors.

● Ensuring Measurement Accuracy

1) When extending or connecting the thermocouple lead wire, be sure to use compensating wires that match the thermocouple types.
2) When extending or connecting the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance and keep the resistance of the three lead wires the same.
3) Mount the Temperature Controller so that it is horizontally level.
4) If the measurement accuracy is low, check to see if input shift has been set correctly.

● Precautions for Operation

1) It takes a certain amount of time for the outputs to turn ON from after the power supply is turned ON. Due consideration must be given to this time when designing control panels, etc.
2) It takes 30 minutes from the time the product is turned ON until the correct temperature is indicated. Always turn ON the power supply at least 30 minutes before starting temperature control.
3) Avoid using the Temperature Controller near a radio, television set, or other wireless device. Its use would result in reception disturbance.

Preparations for Use

Be sure to thoroughly read and understand the manual provided with the product, and check the following points.

Timing	Check point	Details
Purchasing the product	Product appearance	After purchase, check that the product and packaging are not dented or otherwise damaged. Damaged internal parts may prevent optimum control.
	Product model and specifications	Make sure that the purchased product meets the required specifications.
Setting the Unit	Product installation location	Provide sufficient space around the product for heat dissipation. Do not block the vents on the product.
Wiring	Terminal wiring	Do not subject the terminal screws to excessive stress (force) when tightening them. Make sure that there are no loose screws after tightening terminal screws to the specified torque of 0.40 to 0.56 N·m.
		Be sure to confirm the polarity for each terminal before wiring the terminal block and connectors.
	Power supply inputs	Wire the power supply inputs correctly. Incorrect wiring will result in damage to the internal circuits.
Operating environment	Ambient temperature	The ambient operating temperature for the product is –10 to 55°C (with no condensation or icing). To extend the service life of the product, install it in a location with an ambient temperature as low as possible. In locations exposed to high temperatures, if necessary, cool the products using a fan or other cooling method.
	Vibration and shock	Check whether the standards related to shock and vibration are satisfied at the installation environment. (Install the product in locations where the conductors will not be subject to vibration or shock.)
	Foreign particles	Install the product in a location that is not subject to liquid or foreign particles entering the product. If sulfide, chlorine, or other corrosive gases are present, remove the source of the gas, install a fan, or use other countermeasures to protect the product.

Related Manuals

The manuals related to the EJ1 are configured as shown in the following tables. Refer to these manuals as required.

■ EJ1

Name	Cat. No.	Contents
EJ1 EJ1N-TC2□ EJ1N-TC4□ EJ1N-HFU□ EJ1C-EDU□ Modular Temperature Controllers User's Manual	H142 (This manual)	Describes the following information on the EJ1. • Overview and features • Basic specifications • System design • System configuration • Mounting and wiring • Maintenance • Troubleshooting
CX-Thermo Ver. □ (online help) EST2-2C-MV□	--- (Available only as online help.)	Describes how to set parameters and adjust devices (i.e., components such as Temperature Controllers) using the CX-Thermo.

■ CS/CJ-series PLC Manuals

Name	Cat. No.	Contents
SYSMAC CJ Series CJ2H-CPU□□-EIP CPU Unit Hardware Manual	W472	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CJ-series PLCs.
SYSMAC CJ Series CJ2H-CPU□□-EIP CPU Unit Software Manual	W473	Describes programming and other methods to use the functions of the CJ-series PLCs.
SYSMAC CJ Series CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, NSJ□-□□□□(B)-G5D, NSJ□-□□□□(B)-M3D Programmable Controllers Operation Manual	W393	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CJ-series PLCs.
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, NSJ□-□□□□(B)-G5D, NSJ□-□□□□(B)-M3D Programmable Controllers Programming Manual	W394	Describes programming and other methods to use the functions of the CS/CJ-series PLCs.
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ2H-CPU□□-EIP, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, NSJ□-□□□□(B)-G5D, NSJ□-□□□□(B)-M3D Programmable Controllers Instructions Reference Manual	W474	Describes the ladder diagram programming instructions supported by CS/CJ-series PLCs.
SYSMAC CS Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H Programmable Controllers Operation Manual	W339	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CS-series PLCs.

Name	Cat. No.	Contents
SYSMAC CS/CJ/NSJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, CS1W-SCB□□-V1, CS1W-SCU□□-V1, CJ1W-SCU□□-V1, CP1H-X□□□□-□, CP1H-XA□□□□-□, CP1H-Y□□□□-□, Communications Commands Reference Manual	W342	Describes the C-series (Host Link) and FINS communications commands used with CS/CJ-series PLCs.
SYSMAC CS/CJ Series CS1W-SCB□□-V1, CS1W-SCU□□-V1, CJ1W-SCU21□□-V1 Serial Communications Boards/Units Operation Manual	W336	Describes the use of Serial Communications Unit and Boards to perform serial communications with external devices, including the usage of standard system protocols for OMRON products.

■ CP-series PLC Manuals

Name	Cat. No.	Contents
CP1H-X40D□-□ CP1H-XA40D□-□ CP1H-Y20DT-D SYSMAC CP Series CP1H CPU Unit Operation Manual	W450	Provides the following information on the CP Series: • Overview, design, installation, maintenance, and other basic specifications • Features • System configuration • Mounting and wiring • I/O memory allocation • Troubleshooting Use this manual together with the *CP1H Programmable Controllers Programming Manual* (W451).
CP1H-X40D□-□ CP1H-XA40D□-□ CP1H-Y20DT-D SYSMAC CP Series CP1H CPU Unit Programming Manual	W451	Provides the following information on the CP Series: • Programming instructions • Programming methods • Tasks • File memory • Functions Use this manual together with the *CP1H Programmable Controllers Operation Manual* (W450).
CP1L-L10D□-□ CP1L-L14D□-□ CP1L-L20D□-□ CP1L-M30D□-□ CP1L-M40D□-□ CP1L-M60D□-□ SYSMAC CP Series CP1L CPU Unit Operation Manual	W462	Provides the following information on the CP Series: • Overview, design, installation, maintenance, and other basic specifications • Features • System configuration • Mounting and wiring • I/O memory allocation • Troubleshooting Use this manual together with the *CP1L Programmable Controllers Programming Manual* (W451).

Name	Cat. No.	Contents
CP1H-X40D□-□ CP1H-XA40D□-□ CP1H-Y20DT-D CP1L-L10D□-□ CP1L-L14D□-□ CP1L-L20D□-□ CP1L-M30D□-□ CP1L-M40D□-□ CP1L-M60D□-□ SYSMAC CP Series CP1H /CP1L CPU Unit Programming Manual	W451	Provides the following information on programming the CP Series: • Programming methods • Tasks • Programming instructions
CP1L-L10D□-□ CP1L-L14D□-□ CP1L-L20D□-□ CP1L-M30D□-□ CP1L-M40D□-□ CP1L-M60D□-□ SYSMAC CP Series CP1L CPU Unit Introduction Manual	W461	Describes basic setup methods of CP1L PLCs: • Basic configuration and component names • Mounting and wiring • Programming, data transfer, and debugging using the CX-Programmer • Application program examples

■ G3ZA Multi-channel Power Controller Manual

Name	Cat. No.	Contents
G3ZA G3ZA-4H203-FLK-UTU G3ZA-4H403-FLK-UTU G3ZA-8H203-FLK-UTU G3ZA-8H403-FLK-UTU Multi-channel Power Controller User's Manual	Z200	Provides an outline of and describes the features, installation, wiring, RS-485 serial communications settings, and basic function for the G3ZA Multi-channel Power Controller.

■ G3PW Power Controller Manual

Name	Cat. No.	Contents
G3PW G3PW-A220EC-C-FLK G3PW-A230EC-C-FLK G3PW-A245EC-C-FLK G3PW-A260EC-C-FLK G3PW-A220EC-S-FLK G3PW-A230EC-S-FLK G3PW-A245EC-S-FLK G3PW-A260EC-S-FLK Power Controller User's Manual	Z280	Provides an outline of and describes the features, installation, wiring, RS-485 serial communications settings, and basic function for the G3PW Power Controller.

■ Programmable Terminal (PT) Manuals

Name	Cat. No.	Contents
NS-Series NS5-SQ0□(B)-V1/V2, NS5-TQ0□(B)-V2, NS5-MQ0□(B)-V2, NS8-TV□□(B)-V1/V2, NS10-TV0□(B)-V1/V2, NS12-TS0□(B)-V1/V2, NS5-SQ1□□-V2, NS5-TQ1□□-V2, NS5-MQ1□□-V2 Programmable Terminals Setup Manual	V083	Provides an outline of, and describes the design, installation, maintenance, and other basic operations for the NS-series PTs. Information is also included on connecting to hosts and peripheral devices, and settings required for communications and PT operation.
NS-Series NS5-SQ0□(B)-V1/V2, NS5-TQ0□(B)-V2, NS5-MQ0□(B)-V2, NS8-TV□□(B)-V1/V2, NS10-TV0□(B)-V1/V2, NS12-TS0□(B)-V1/V2, NS5-SQ1□□-V2, NS5-TQ1□□-V2, NS5-MQ1□□-V2 Programmable Terminals Programming Manual	V073	Describes the functions of NS-series PTs, including screen configurations, object functions, and host communications for the PT.

Name	Cat. No.	Contents
NSJ-Series NSJ5-TQ□□(B)-G5D NSJ5-SQ□□(B)-G5D NSJ8-TV□□(B)-G5D NSJ10-TV□□(B)-G5D NSJ12-TS□□(B)-G5D NSJ5-TQ□□(B)-M3D NSJ5-SQ□□(B)-M3D NSJ8-TV□□(B)-M3D NSJ Series Operation Manual	W452	Provides the following information about the NSJ-series NSJ Controllers: Overview and features Designing the system configuration Installation and wiring I/O memory allocations Troubleshooting and maintenance Use this manual in combination with the following manuals: SYSMAC CS Series Operation Manual (W339), SYSMAC CJ Series Operation Manual (W393), SYSMAC CS/CJ Series Programming Manual (W394), and NS-V1/-V2 Series Setup Manual (V083)
NSH Series NSH5-SQR00B-V2 NSH5-SQG00B-V2 Hand-held Programmable Terminal Operation Manual	V090 (PDF only)	Provides an outline of, and describes the design, installation, maintenance, and other basic operations for the NSH-series NSH5 Hand-held Programmable Terminal. Information is also included on features, system configuration, wiring, I/O memory allocations, and troubleshooting.
NS Series NS-CA002 Programmable Terminals RGB and Video Input Unit Operation Manual	V086 (PDF only)	Describes how to display external video images or analog RGB imagines on NS-series PTs using a NS-series RGB and Video Input Unit, including the following information. • Features, system configuration, and specifications • Functions, setting methods, and adjustment methods
Smart Active Parts Reference Manual	V087 (PDF only)	Describes the Smart Active Parts (SAP) functionality and the settings required to use the SAP library. This document does not describe application restrictions for specific Units or Components or restrictions in combinations. Always refer to the operation manual for the products involved before using the SAP library.

■ Support Software Manuals

Name	Cat. No.	Contents
CXONE-AL□□C-EV3/AL□□D-EV3 CX-One Ver. 3.0 FA Integrated Tool Package Setup Manual	W463	Installation and overview of CX-One FA Integrated Tool Package.
CXONE-AL□□C-EV3/ CXONE-AL□□D-EV3 CX-Integrator Ver. 3.0 Operation Manual	W464	Describes operating procedures for the CX-Integrator Network Configuration Tool for CS-, CJ-, CP-, and NSJ-series Controllers.
SYSMAC WS02-CXPC□-E-V8 CX-Programmer Operation Manual	W446	Provides information on how to use the CX-Programmer for all functionality except for function blocks. Refer to the following manuals when programming: *CJ Series CPU Unit Hardware Manual* (Cat. No. W472) and *CJ Series CPU Unit Software Manual* (Cat. No. W473). CS Series: *Operation Manual for Setup* (Cat. No. W339) and *Programming Manual for Programmable Controllers* (Cat. No. W394) CJ Series: *CJ Series Programmable Controllers Operation Manual* (Cat. No. W393) and *Programming Manual for Programmable Controllers* (Cat. No. W394)
SYSMAC WS02-CXPC□-E-V8 CX-Programmer Ver. 8.0 Operation Manual Function Blocks (CS1G-CPU□□H, CS1H-CPU□□H, CJ1G-CPU□□H, CJ1H-CPU□□H, CJ1M-CPU□□, CP1H-X□□□□-□, CP1H-XA□□□□-□, CP1H-Y□□□□-□ CPU Units)	W447	Describes the functionality unique to the CX-Programmer Ver. 7.0 and CP-series CPU Units or CS/CJ-series CPU Units with unit version 3.0 or later based on function blocks. Functionality that is the same as that of the CX-Programmer is described in W446 (enclosed).
SYSMAC CX-Designer Ver. 1.0 NS-CXDC1-V1 Operation Manual	V088	Describes how to install and use the CX-Designer, including screen data creation methods, screen data transfer methods, and system settings.
NS-Series NS5-SQ0□(B)-V1/V2 NS5-TQ0□(B)-V2 NS5-MQ0□(B)-V2 NS8-TV□□(B)-V1/V2 NS10-TV0□(B)-V1/V2 NS12-TS0□(B)-V1/V2 NSJ5-TQ□□(B)-G5D NSJ5-SQ□□(B)-G5D NSJ8-TV□□(B)-G5D NSJ10-TV□□(B)-G5D NSJ12-TS□□(B)-G5D Ladder Monitor Operation Manual (Ladder Monitor/I/O Comment Extracting Tool)	V082	Describes the NS-series PT monitoring function for CS/CJ-series PLC ladder programs, including the following information. • Overview and features • Setup methods • Basic operations • Troubleshooting

Conventions Used in This Manual

Meanings of Abbreviations

The following abbreviations are used in parameter names, figures and in text explanations. These abbreviations mean the following:

Symbol	Term
TC4/TC2	Four-channel and Two-channel Basic Units
ch	Channel
HFU	Advanced Unit
EDU	End Unit
PV	Process value
SP	Set point
RSP	Remote SP
LSP	Local SP
LBA	Loop burnout alarm
HB	Heater burnout
HS	Heater short
OC	Heater overcurrent
AT	Autotuning
ST	Self-tuning
EU	Engineering unit (See note.)

Note "EU" stands for Engineering Unit. EU is used as the minimum unit for engineering units such as °C, m, and g. The size of EU varies according to the input type.
For example, when the input temperature setting range is –200 to +1300°C, 1 EU is 1°C, and when the input temperature setting range is –20.0 to +500.0°C, 1 EU is 0.1°C.
For analog inputs, the size of EU varies according to the decimal point position of the scaling setting, and 1 EU becomes the minimum scaling unit.

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About this Manual:

This manual describes the EJ1 Modular Temperature Controllers and includes the sections described below. Please read this manual carefully and be sure you understand the information provided before attempting to set up or operate an EJ1 Modular Temperature Controller.

• Overview

Section 1 Outline describes the features, nomenclature, and functions of the EJ1.

• Setup

Section 2 Preparations describes the preparations required to use the EJ1, including installation, wiring, and switch settings.

• Application Examples

Section 3 Typical Control Examples describes the basic applications of the EJ1 using specific control examples.

• Functions of EJ1 Basic Units (TC4/TC2)

Section 4 Basic Units (TC4 and TC2) Functions describes the functions of EJ1 Basic Units.

• Functions of the EJ1 Advanced Unit (HFU)

Section 5 Advanced Unit (HFU) Functions describes the functions of EJ1 Advanced Unit.

• Operation Using Communications

Section 6 CompoWay/F Communications and ***Section 7 Modbus Communications*** describe how to use communications based on communications commands.

• Troubleshooting

Section 8 Errors and Error Processing describes methods for checking possible problems in operation depending on classifications of Temperature Controller status.

• Specifications and Parameter Lists

Appendix provides specifications, parameter lists, status lists, and other reference information.

⚠ WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Functional Upgrades

V1.2

The EJ1C-EDUC-NFLK (with connector terminal block) has been added to the End Units (EDU) and the functions of previous models have been improved. Information in this manual related to improved functionality is indicated with the **V1.2** mark. The improved functionality is outlined below.

• Basic Units (TC4/TC2)

- Autotuning is provided for heating/cooling control.
- Self-tuning has been added.
- A switch can be used to display the output status on the operation indicators during operation.
- Modbus communications can be used to read and write all parameters, and to executed any of the operation commands.
- A switch setting can be changed to use Modbus communications on port B.
- A switch setting can be used to set the baud rate of port B.
- A C0/80 status has been added for to the variable types.
- Up to eight G3PW Power Controllers can be connected to one Basic Unit.

Note 1. The G3PW can be connected to EJ1 V1.1.

2. The G3PW and G3ZA cannot be used together.

• Advanced Unit (HFU)

- Bit specification operation commands have been added to the parameters that can be specified for programless download settings. This simplifies the program when operation commands are executed.
- The G3ZA or G3PW Monitor parameter has been added to the parameters that can be specified for programless upload settings. Up to four G3ZA Multi-channel Power Controllers or up to four G3PW Power Controllers can be connected to one TC4/ TC2 Unit.
- The maximum number of parameters that can be specified for programless upload/download setting has been increased from 600 to 1200 each.
- The maximum number of TC4/TC2 Units that an HFU can control has been increased from 16 to 32 Units.
- Communications unit numbers 32 to 39 can be used in the HFU via programless communications. This allows the communications unit numbers of TC4/TC2 connected to an HFU to be numbered sequentially, making it easy to copy HFU and TC settings to other HFUs and TCs.

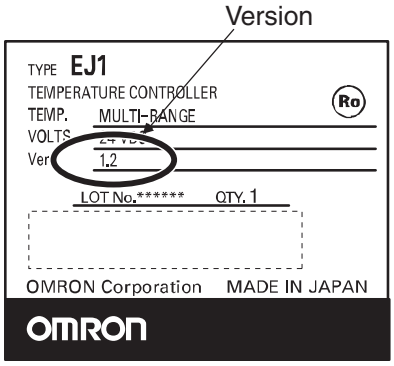
• Support Software

Use version 4.10 or higher of the CX-Thermo when using the upgraded functions.

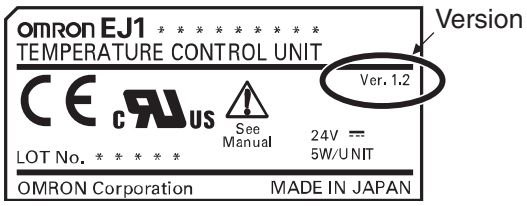
• Identifying Upgraded Models

The new functionality can be used with version 1.2 (V1.2). Check the label on the Temperature Controller or the box to determine the version. Models not marked “Ver. 1.1” are version 1.0.

Box Label



Temperature Controller Label



Functional Upgrades

V1.1

EJ1 Temperature Controllers with linear outputs (EJ1N-TC2A-CNB and EJ1N-TC2B-CNB) have been added and the functions of the previous EJ1 Controllers with pulse outputs have been improved. Information in this manual related to improved functionality is indicated with this mark: **V1.1**. The improved functionality is outlined below.

• Basic Units (TC4/TC2)

- Modbus communications can be used on port B.
- Software version 2 of the G3ZA Multi-channel Power Controller can be used.

Note 1. When more than one G3ZA Multi-channel Power Controller is connected, version 1 and version 2 can be mixed. (Up to 8 G3ZA Multi-channel Power Controllers can be connected.)

2. Software version 2 of G3ZA Multi-channel Power Controller can also be used with EJ1 version 1.0.

• Advanced Unit (HFU)

- Programless communications can be used with 1: N connections.
- The maximum number of parameters that can be specified for programless upload/download settings has been increased from 300 to 600 each.
- Connection is now possible to MELSEC-QnA/An/AnS/FX3uc-series PLCs.
- A new setting read operation has been added to programless communications: Setting Read 2.
- The speed of programless communications has been increased.
- Either “continue” or “stop” can be selected for when errors occur in programless communications.

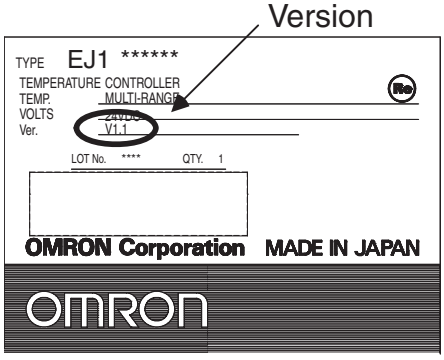
• Support Software

Use version 3.20 or higher of the CX-Thermo when using the upgraded functions.

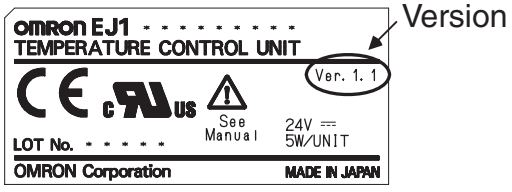
• Identifying Upgraded Models

The new functionality can be used with version 1.1 (V1.1). Check the label on the Temperature Controller or the box to determine the version. Models not marked “Ver. 1.1” are version 1.0.

Box Label



Temperature Controller Label



SECTION 1
Outline

This section describes the features, nomenclature, and functions of the EJ1.

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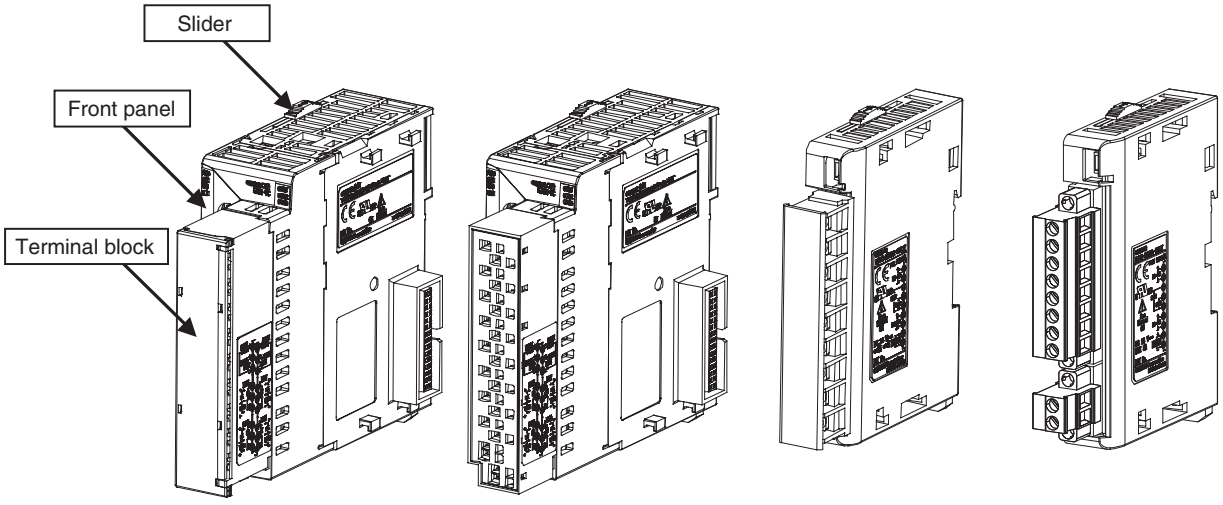
1-1 Names of Parts

1-1-1 Appearance



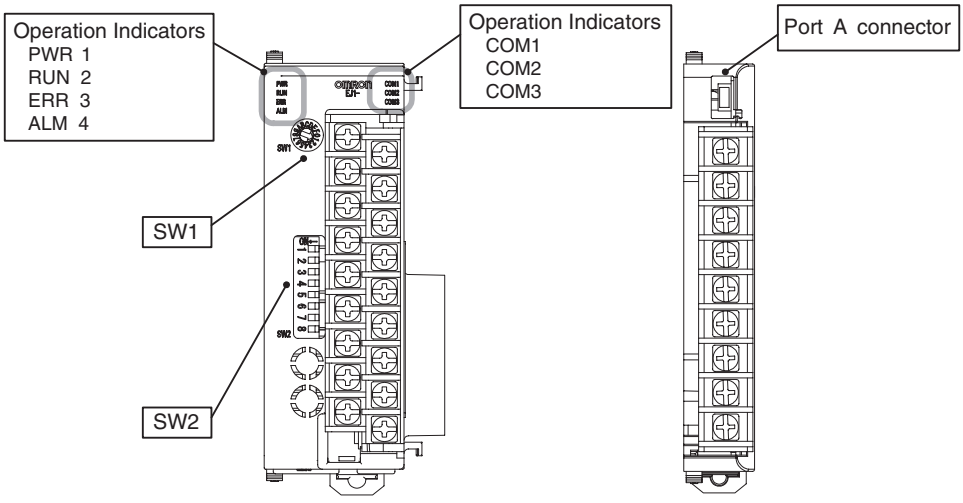
TC4, TC2, or HFU
Screw Terminals

TC4, TC2, or HFU
Screw-Less Clamp Terminals

EDUA
Models with Screw Terminals

EDUC
Connector terminal block model

1-1-2 Names of Parts on Front Panel



TC4, TC2, or HFU

EDU

1-1-3 Meanings of Indicators

Operation Indicators

TC4 and TC2

Name	Color	Meaning: When SW2 No. 6 is OFF	Meaning: When SW2 No. 6 is ON V1.2
PWR/1 V1.2	Green	Lights when the power is ON.	Lit when output 1 is ON.
RUN/2 V1.2	Green	Lights during operation.	Lit when output 2 is ON.
ERR/3 V1.2	Red	Flashes or lights when an error occurs.	Lit when output 3 is ON.
ALM/4 V1.2	Red	Lights when an alarm is activated.	Lit when output 4 is ON.
COM1	Orange	Flashes during communications via port A on the End Unit.	
COM2	Orange	Flashes during communications via port B on the End Unit.	
COM3	Orange	Flashes during communications with the G3ZA.	

HFU

Name	Color	Meaning
PWR	Green	Lights when the power is ON. (See note.)
RUN	Green	---
ERR	Red	Flashes or lights when an error occurs.
ALM	Red	Lights when an alarm is activated.
COM1	Orange	Flashes during communications via port A on the End Unit.
COM2	Orange	Flashes when the EJ1 system is in operation.
COM3	Orange	Flashes during communications via port C.

Note Some time is required for the indicators to light after the power is turned ON.

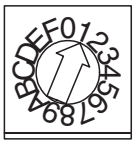
1-1-4 Using Setting Switches

- Check that the EJ1 is turned OFF before operating the switches. The settings are enabled when the power is turned ON.
- Set the switches with a small flat-blade screwdriver. Do not set the switches midway between settings.

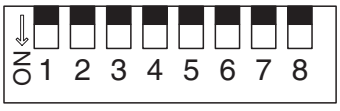
Setting the Unit Number

SW1 and SW2 are used together to set the unit number to between 00 and 63.

Note The factory setting is unit number 01.



SW1



SW2

Unit Number Settings

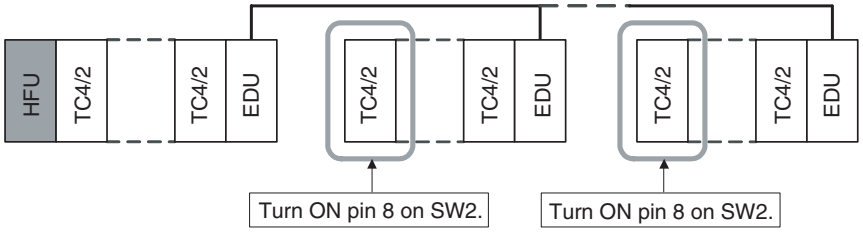
SW2		SW1															
1	2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
OFF	OFF	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ON	OFF	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
OFF	ON	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
ON	ON	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63

Setting Switch 2 (SW2) Settings

EJ1□-TC Basic Units

SW2	Meaning
3 **V1.2**	Set to ON when using the Modbus communications protocol for port B. OFF: The setting for port B communications protocol is used. ON: Modbus is used.
4 to 5 **V1.2**	Set the baud rate of port B. 4 = OFF, 5 = OFF: Use the baud rate parameter setting for port B (default: 9.6 kbps). 4 = ON, 5 = OFF: 19.2 kbps 4 = OFF, 5 = ON: 38.4 kbps 4 = ON, 5 = ON: 115.2 kbps
6 **V1.2**	Set to ON to display the output status on the operation indicators. OFF: The operation status is displayed (PWR, RUN, ERR, and ALM). ON: The output status is displayed (outputs 1, 2, 3, and 4). **Note** Normally keep this pin set to OFF so that the operation status can be checked.
7	ON: G3ZA Multi-channel Power Controller in operation ON when using a G3PW Power Controller. **V1.1**
8	Use when an HFU is used and Units are distributed. (See note.)

Note To use an HFU with distributed positioning, turn ON pin number 8 on SW2 on the TC Unit connected at the left end of the Block.
Refer to *SECTION 2 Preparations* for information on wiring.



Note Make sure power to the Unit is turned OFF before changing the setting of any pin other than pin number 6. Pin number 6 can be turned ON or OFF while the power is ON.

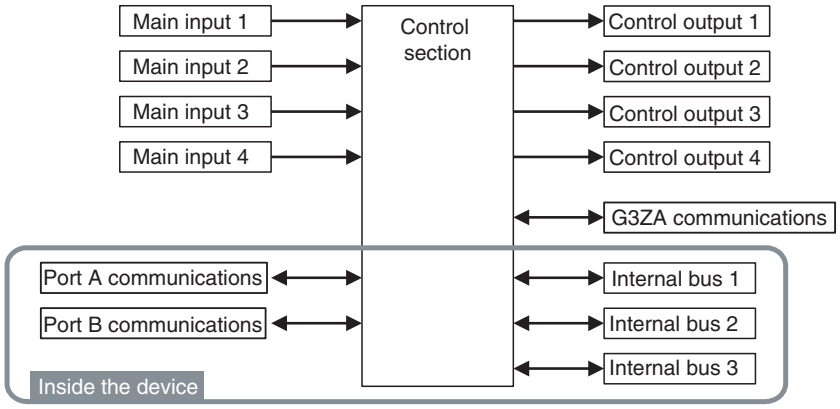
EJ1□-HFU (Advanced Unit)

SW2	Meaning
3 to 7	Not used (OFF)
8	• EJ1□-HFU□-NFLK OFF: RS-485 is selected. ON: RS-232C is selected. • EJ1□-HFU□-NFL2 Not used (OFF).

1-2 I/O Configuration and Main Functions

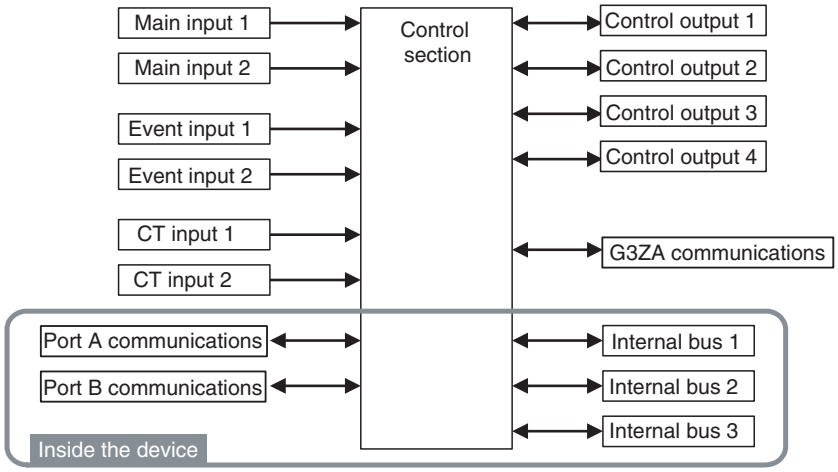
1-2-1 I/O Configuration

TC4: Four-channel Basic Unit



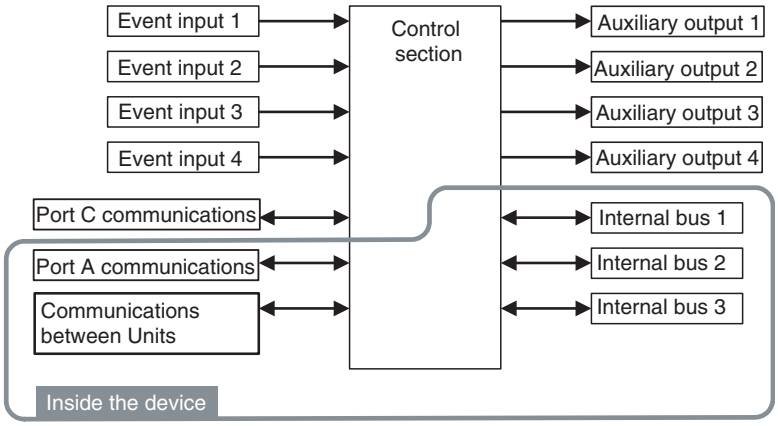
- Internal device I/O are connected via a connector to the adjacent Unit.

TC2: Two-channel Basic Unit



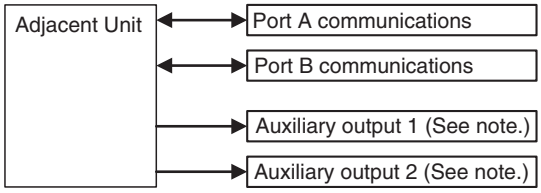
- Internal device I/O are connected via a connector to the adjacent Unit.

HFU (Advanced Unit)



- Internal device I/O are connected via a connector to the adjacent Unit.
- Communications between devices are connected to TC4 or TC2 host device communications.

EDU: End Unit



Note Auxiliary outputs are output via an internal bus.

1-2-2 Main Unit Functions

Basic Units (TC4 and TC2)

- The Basic Units are modular temperature controllers with I/O.
- There are two models of Basic Unit: The TC4 with four I/O channels and the TC2 with two I/O channels.
- Up to eight G3ZA Multi-channel Power Controllers, or V1.1 G3PW Power Controllers **V1.1**, can be connected to each Basic Unit.

TC4

- One TC4 Unit controls temperature on 4 channels.
- Multi-input is supported for thermocouple, platinum resistance thermometer, or analog input.
- The type of input can be set separately for each channel.
- Control outputs are pulse voltage outputs.
- Both screw terminals and screw-less clamp terminals are available.
- Terminal blocks can be detached and attached.

TC2

- One TC2 Unit controls temperature on 2 channels.
- Multi-input is supported for thermocouple, platinum resistance thermometer, or analog input.
- The type of input can be set separately for each channel.
- Control outputs are pulse voltage outputs or current outputs
- Connect a current transformer (CT) to use the heater burnout and heater overcurrent alarms.
- There are two event inputs. Any of the following can be used by setting event input assignments: Run/stop, auto/manual, remote SP/local SP, and bank switching.
- Both screw terminals and screw-less clamp terminals are available.
- Terminal blocks can be detached and attached.

Advanced Unit (HFU)

- An HFU monitors the Basic Units and collects data.
- Up to sixteen Basic Units, or 32 version **V1.2** Units, can be connected to one HFU.
- Data can be exchanged between the EJ1 and PLCs using programless communications.
- With version V1.0, up to 300 data items can be read from a PLC to the EJ1 and up to 300 data items can be written from the EJ1 to a PLC. With version **V1.1**, up to 600 data items can be read from a PLC to the EJ1 and up to 600 data items can be written from the EJ1 to a PLC. With version **V1.2**, up to 1,200 data items can be read from a PLC to the EJ1 and up to 1,200 data items can be written from the EJ1 to a PLC.

- OMRON CS/CJ-series PLCs and Mitsubishi Q/QnA/QnAS/An/AnS/FX3UC-series PLCs can be connected. (Version **V1.1** or higher must be used for An/AnS/FX3UC-series PLCs.

End Unit (EDU)

- The End Unit supplies power to connected Basic Units and HFUs.
- An End Unit is always required when using the EJ1.
- A total of up to 16 HFUs and Basic Units can be connected to one End Unit.
- The End Unit has two communications ports: port A and port B. Write Mode is valid for port B. If settings are changed from port A, they are always written to EEPROM. When using port A, be sure to consider the write life of the EEPROM.
- Two communications ports are provided for port A: a connector and terminal block connections.
- The connector communications port can be used as a tool port. The End Unit can be connected to a computer via a special E58-CIFQ1 USB-Serial Conversion Cable to make EJ1 settings using the CX-Thermo Support Software.
- The terminal block communications port can be used to wire between more than one EJ1 for distributed positioning of the EJ1. Up to 64 HFUs and Basic Units can be connected this way.

1-2-3 Model Number Legend

TC4 and TC2

Options	None	
	H	2 CT inputs
	B	2 event inputs
Outputs	Q	2 pulse voltage outputs
	N	2 transistor outputs
Terminal type	A	Screw terminals
	B	Screw-less clamp terminals
Unit name	T C 4	Four-channel Temperature Control Unit
	T C 2	Two-channel Temperature Control Unit
Type	N	Standard control

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	N	-	T	C	4	A	-	Q	Q		
E	J	1	N	-	T	C	4	B	-	Q	Q		
E	J	1	N	-	T	C	2	A	-	Q	N	H	B
E	J	1	N	-	T	C	2	B	-	Q	N	H	B
E	J	1	N	-	T	C	2	A	-	C	N	B	
E	J	1	N	-	T	C	2	B	-	C	N	B	

HFU

Communications	FLK	CompoWay/F (RS-485/RS-232C)
	FL2	CompoWay/F (RS-422)
Outputs	N	4 transistor outputs
Terminal type	A	Screw terminals
	B	Screw-less clamp terminals
Unit name	HFU	Advanced Unit
Type	N	Standard control

1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	N	-	H	F	U	A	-	N	F	L	K
E	J	1	N	-	H	F	U	A	-	N	F	L	2
E	J	1	N	-	H	F	U	B	-	N	F	L	K
E	J	1	N	-	H	F	U	B	-	N	F	L	2

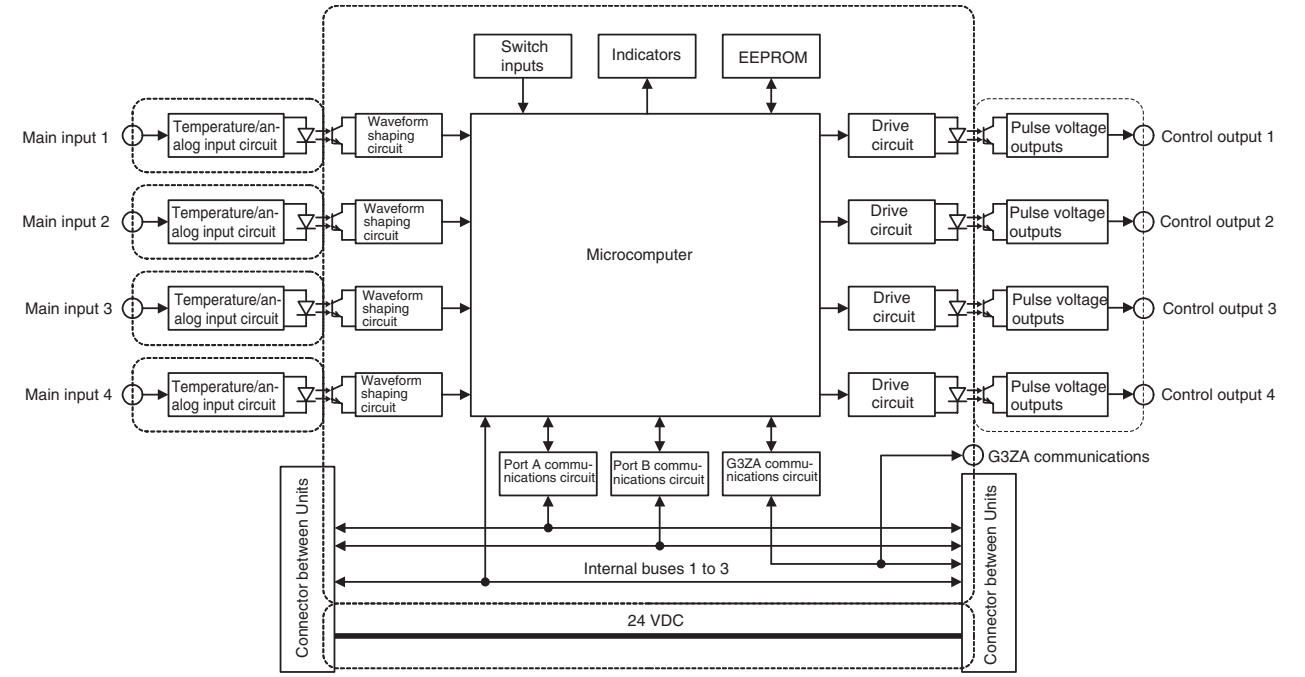
EDU

Communications	FLK	CompoWay/F
Outputs	N	2 transistor outputs
Terminal type	A	Screw terminals
	C	Connector terminal block model
Unit name	EDU	End Unit
Type	C	Common model

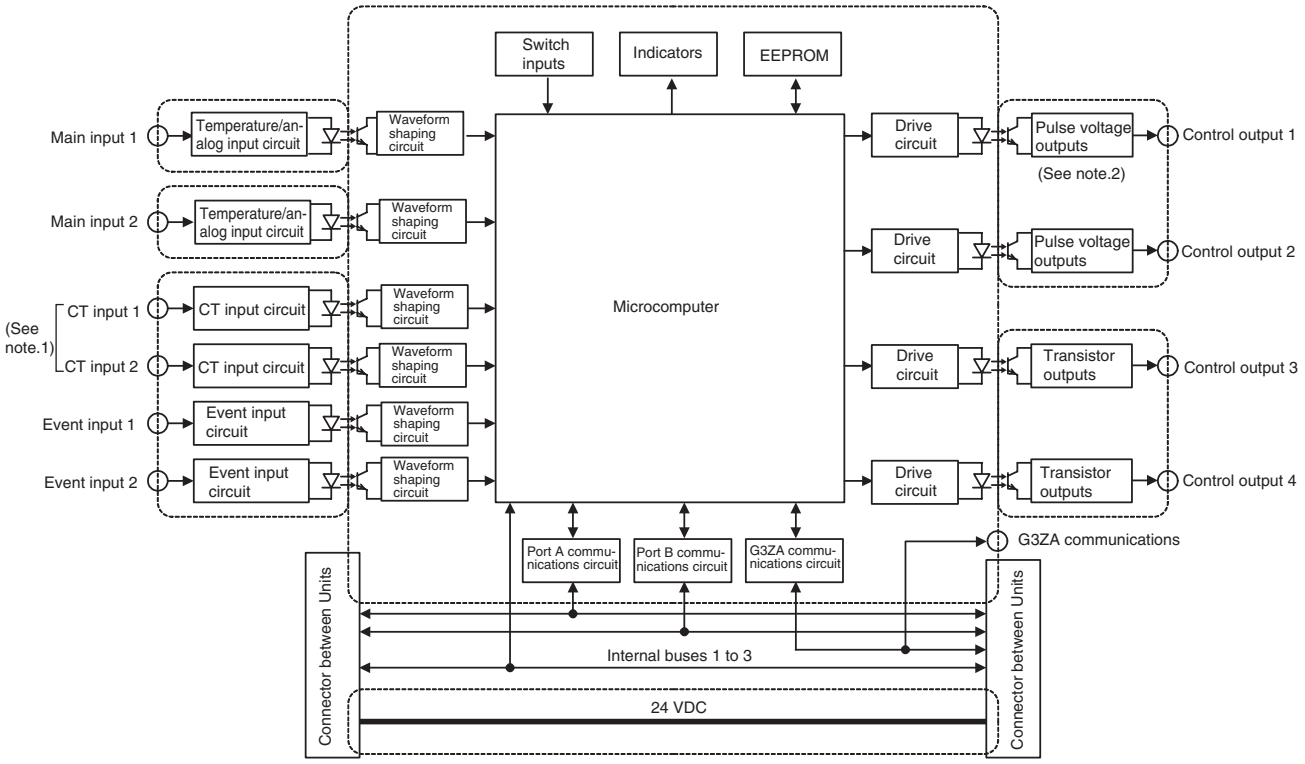
1	2	3	4	5	6	7	8	9	10	11	12	13	14
E	J	1	C	-	E	D	U	A	-	N	F	L	K
E	J	1	C	-	E	D	U	C	-	N	F	L	K

1-3 Internal Block Diagrams

TC4



TC2

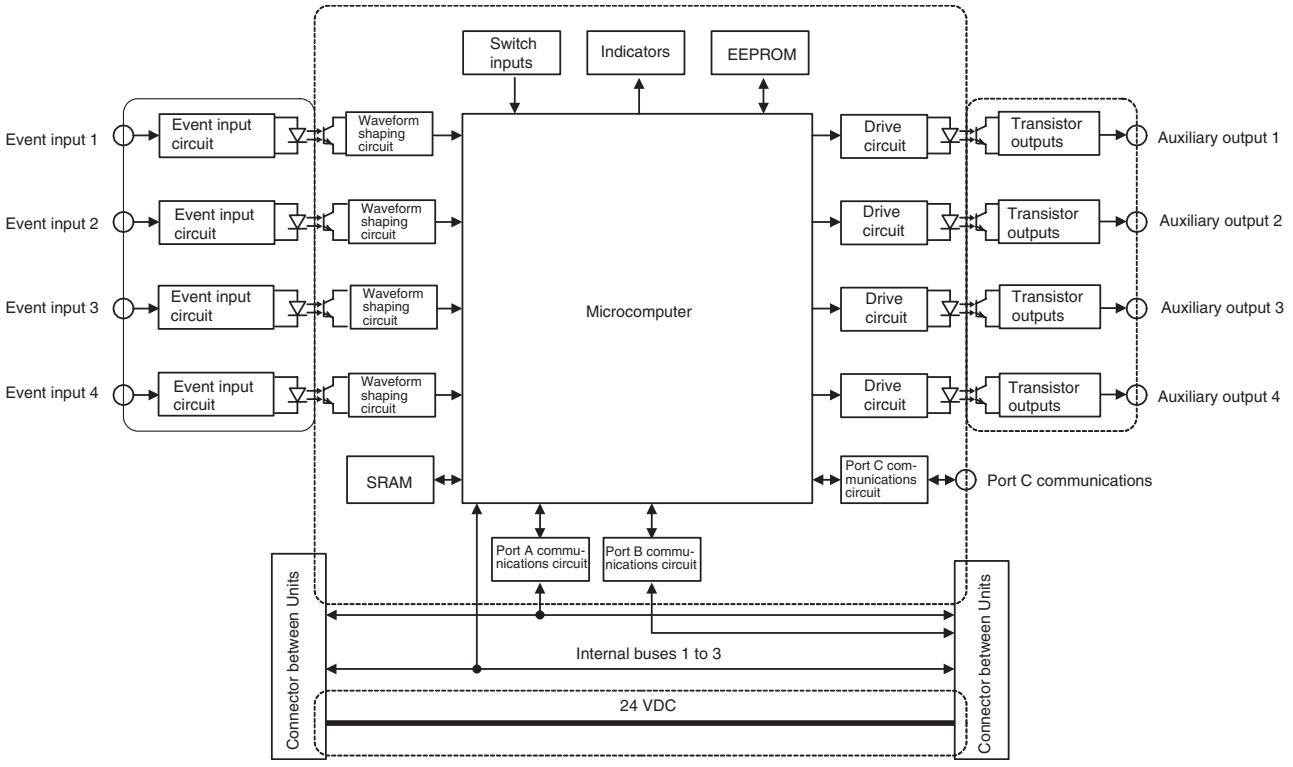


: Functional isolation

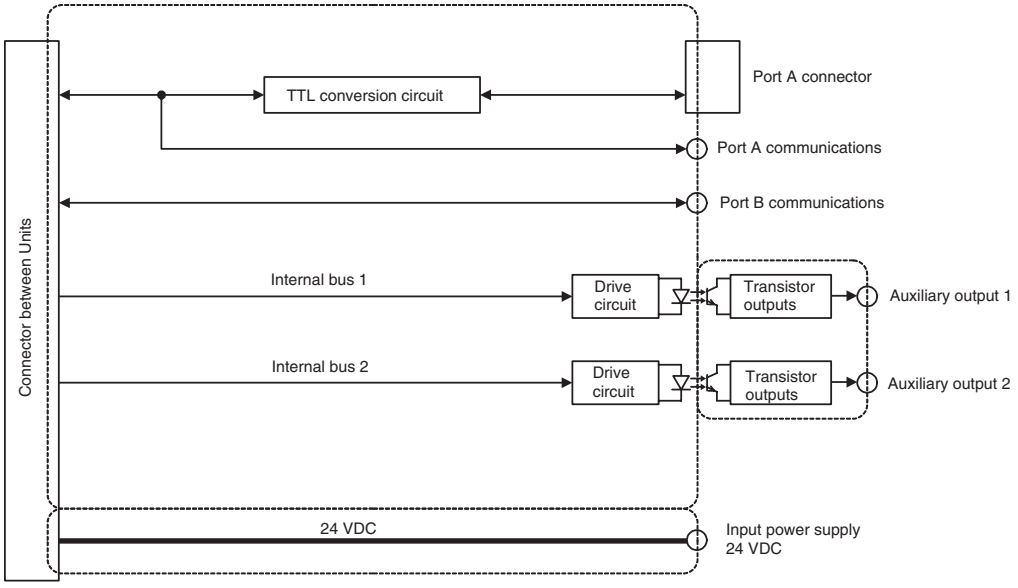
Note (1) The CT inputs are not present on EJ1 Controllers with linear outputs.

(2) These are current outputs on EJ1 Controllers with linear outputs.

HFU



EDU



: Functional isolation

SECTION 2
Preparations

This section describes the preparations required to use the EJ1, including installation, wiring, and switch settings.

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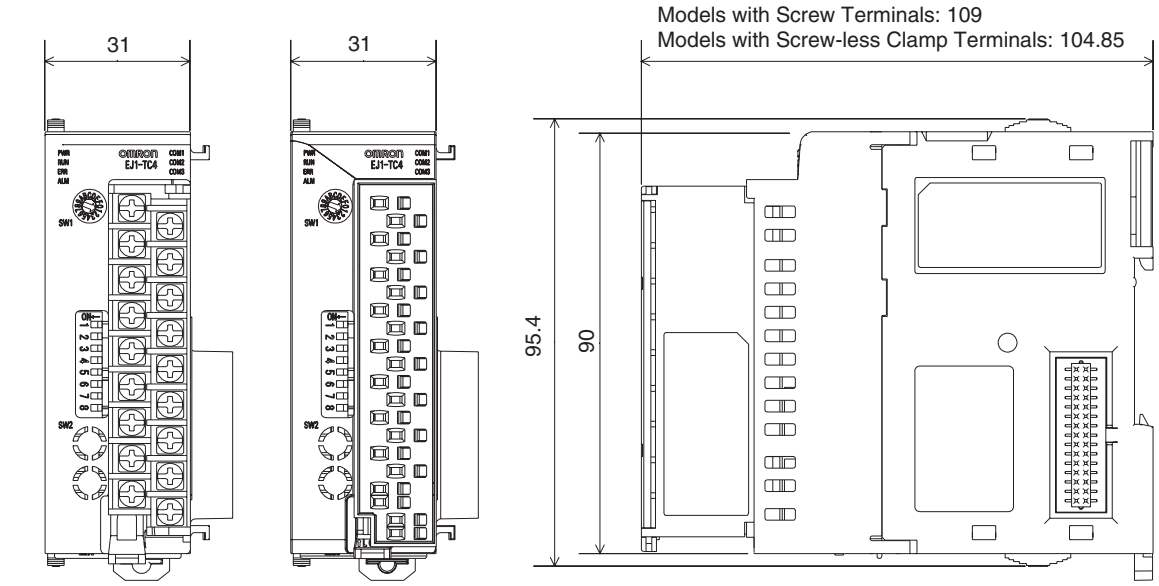
2-1 Installation

2-1-1 Dimensions (Unit: mm)

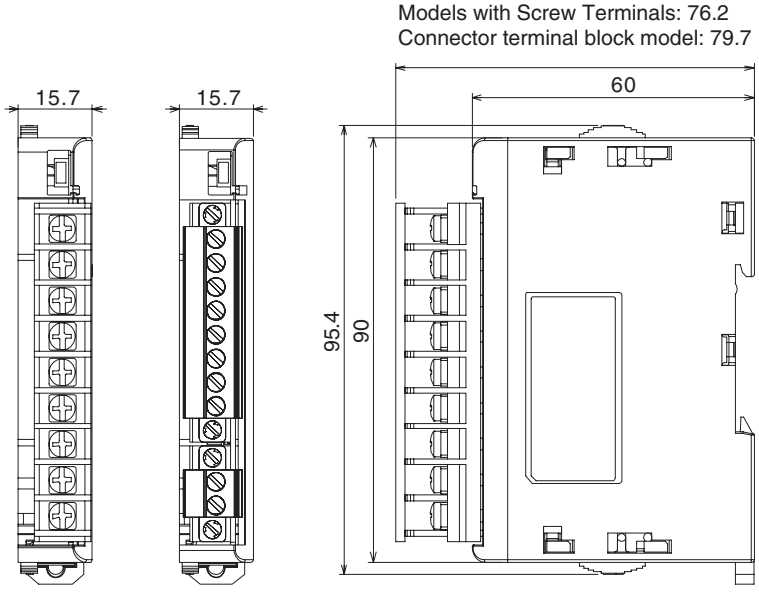
TC4, TC2, and HFU



Models with Screw Terminals

Models with Screw-less Clamp Terminals

EDU



EDUA

Models with Screw Terminals

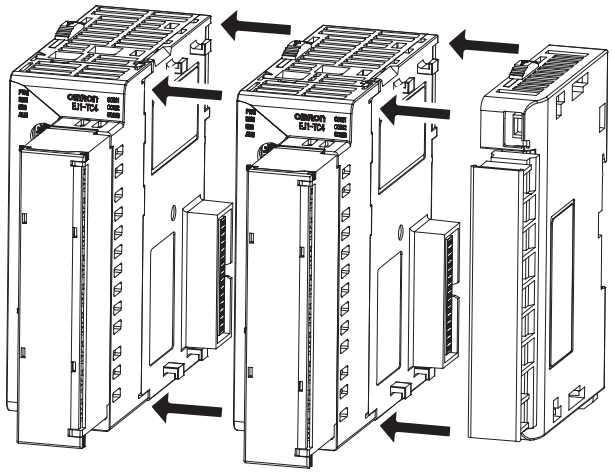
EDUC

Connector terminal block model

2-1-2 Mounting and Removing Terminal Blocks

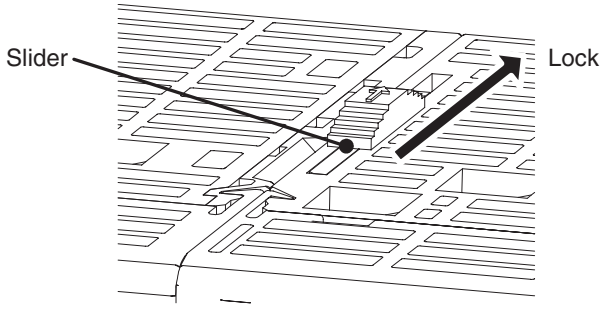
Connecting Units

1,2,3... 1. Align the connectors and connect the Units to each other.

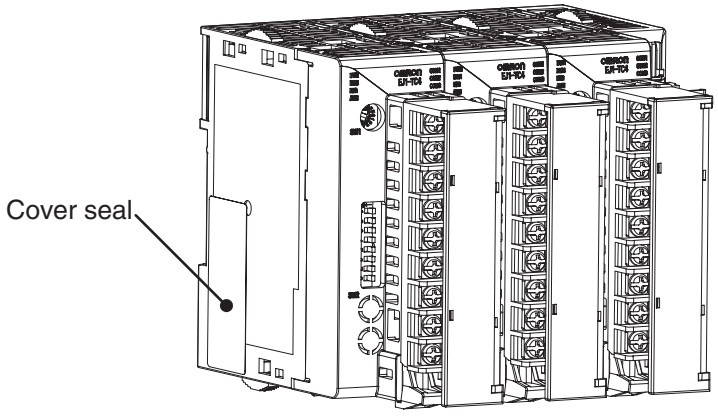


Note Connect the EDU on the right end of the EJ1 and the HFU on the left end.

2. Slide the yellow sliders on the top and bottom of the Units until they click into place.

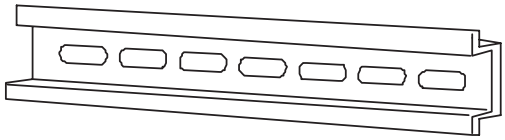


3. Attach the cover seal to the connector on the Unit on the left end of the EJ1.



Mounting to DIN Rail

- Mount the EJ1 to DIN Rail.
- Use screws to secure the DIN Rail in at least 3 locations.



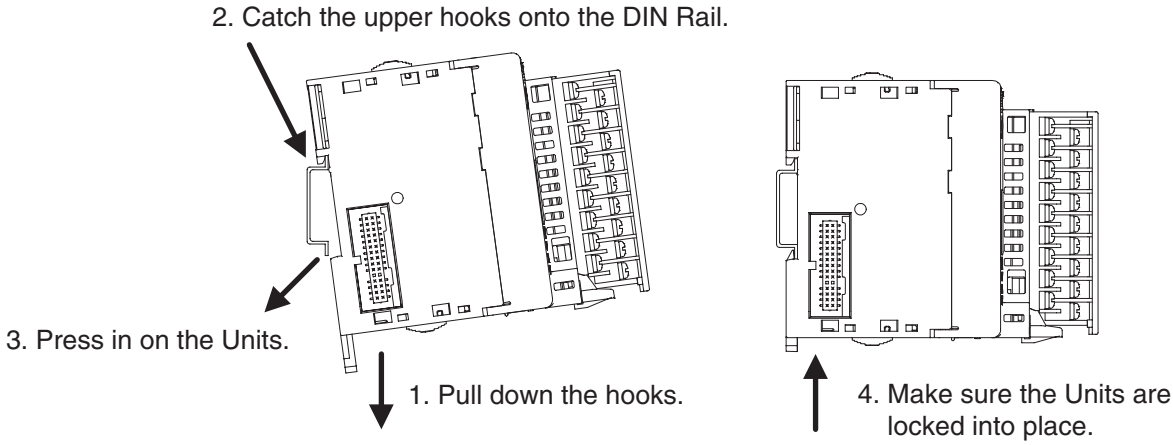
DIN Rail: PFP-50N (50 cm) or PFP-100N (100 cm)

- Install the DIN Rail vertically to the ground.

Vertical: OK Horizontal: NG

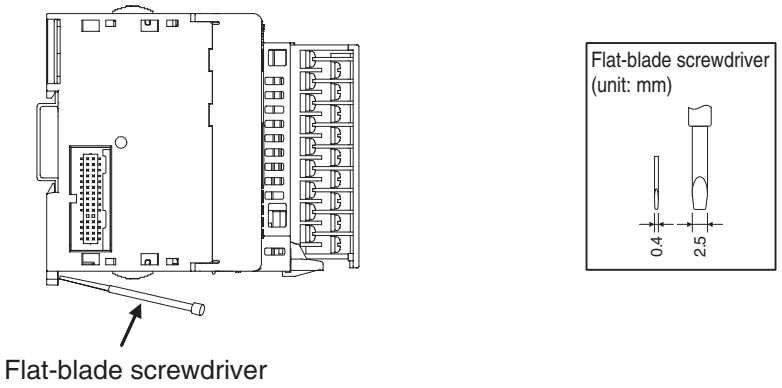
Installation Method

Pull down the hooks on the bottoms of the Units, and then catch the hooks on the tops of the Units onto the DIN Rail and press the Units onto the DIN Rail until they lock into place.

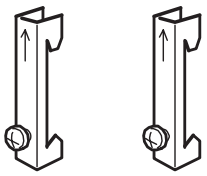

2. Catch the upper hooks onto the DIN Rail.
3. Press in on the Units.
1. Pull down the hooks.
4. Make sure the Units are locked into place.

Removal Method

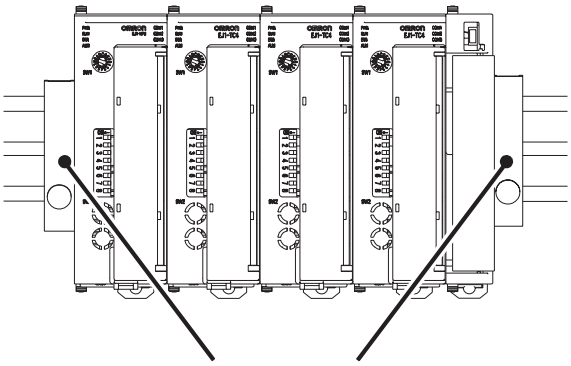
Pull down on the hooks with a flat-blade screwdriver and lift up on the Units.



End Plate Installation Always mount an End Plate on each side of the EJ1.



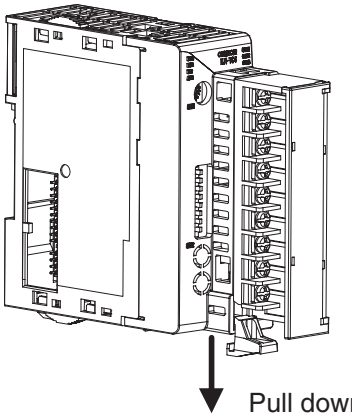
PFP-M End Plates (2)



PFP-M

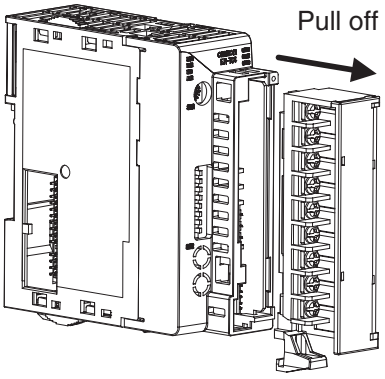
Removing Terminal Blocks

1,2,3... 1. Pull down the terminal block lever.



Pull down the lever.

2. Pull off the terminal block.



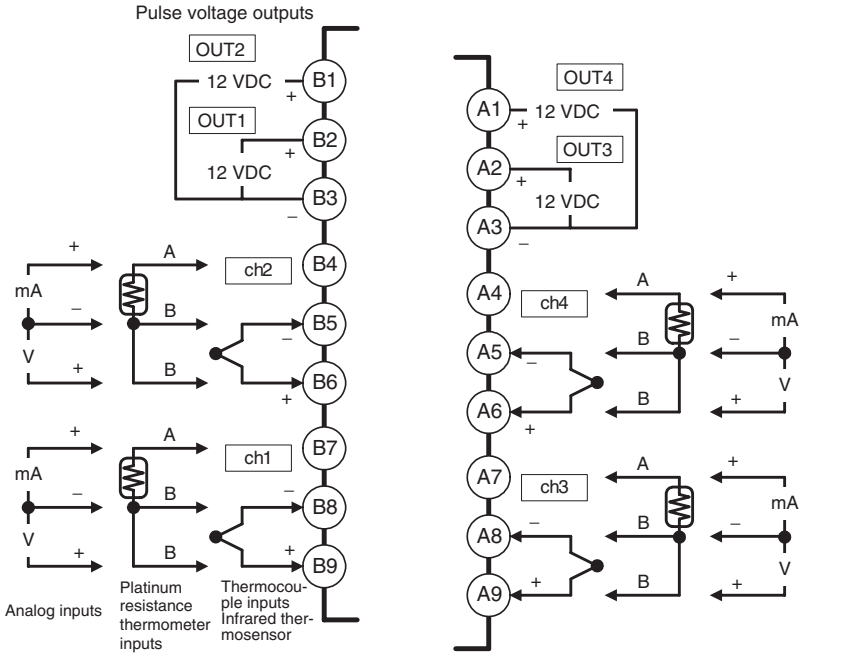
Pull off the terminal block.

Note Screw and screw-less terminal blocks cannot be exchanged. Use the type of terminal block supplied with the TC Unit.

2-2 Wiring Terminals

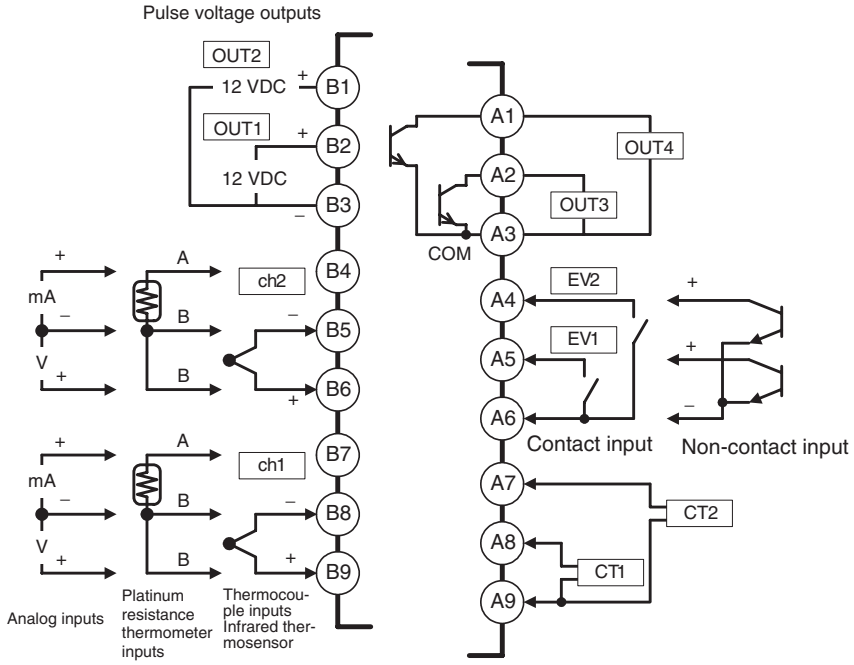
2-2-1 Terminal Arrangement

TC4



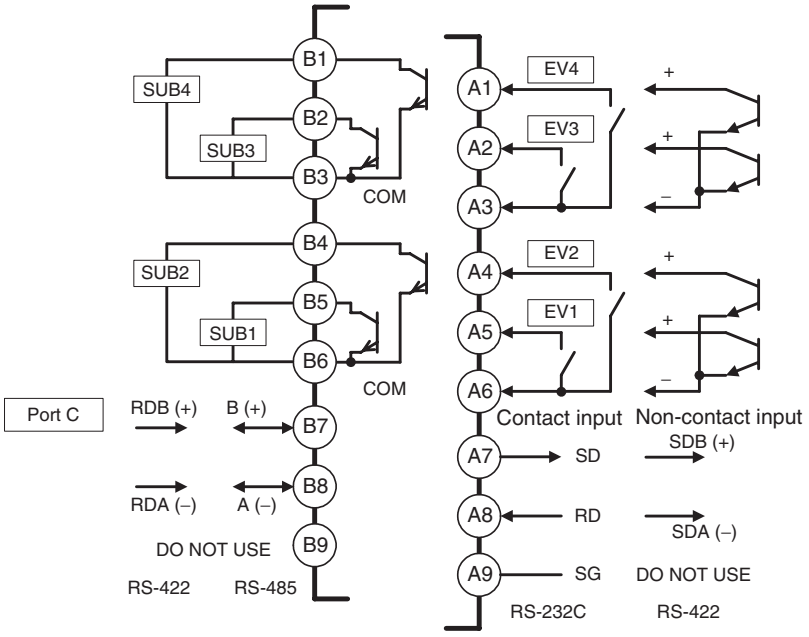
- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.
- A G3ZA connector is located on the bottom of the Unit.
- When wiring voltage inputs, be sure to wire the correct terminals. Incorrect wiring may cause the EJ1 to fail.

TC2



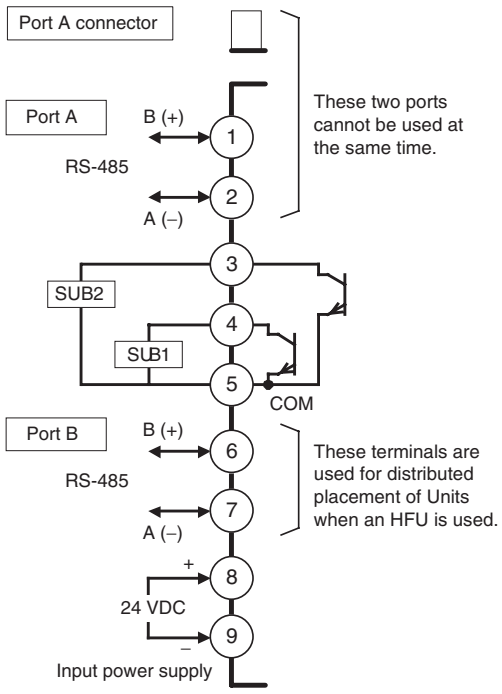
- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.
- A G3ZA connector is located on the bottom of the Unit.
- When wiring voltage inputs, be sure to wire the correct terminals. Incorrect wiring may cause the EJ1 to fail.

HFU

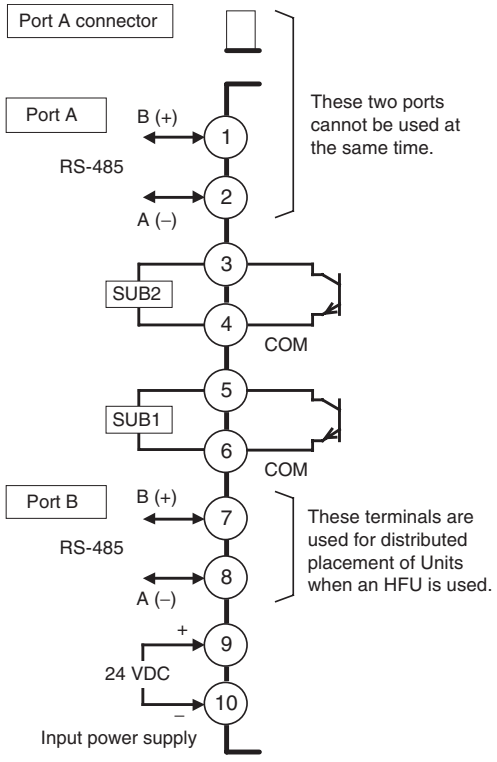


- Terminals A10 and B10 are not used on models with screw-less clamp terminals. Do not connect anything to these terminals.

EDU



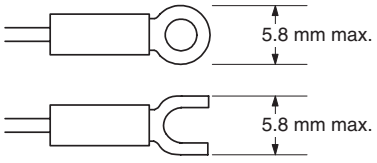
Models with Screw Terminals (EDUA)



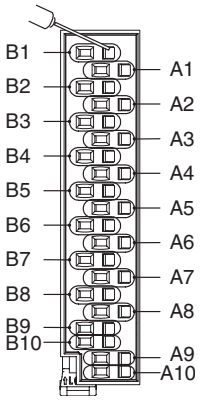
Connector Terminal Block Model (EDUC)

2-2-2 Wiring Precautions

- Separate input leads and power lines to protect the EJ1 from external noise.
- Use AWG22 (cross-sectional area: 0.326 mm^2) to AWG14 (cross-sectional area: 2.081 mm^2) twisted-pair cable for power supply and AWG28 (cross-sectional area: 0.081 mm^2) to AWG16 (cross-sectional area: 1.309 mm^2) for all other cables. The stripping length is 6 to 8 mm.
- Use crimp terminals when wiring the terminals.
- Tighten the terminal screws to a torque of 0.40 to 0.56 N·m.
- Up to two wires of the same size and same type or two crimp terminals can be inserted into a single terminal.
- Use the following types of crimp terminals for M3 screws.



Wiring Procedure for Screw-Less Clamp Terminals



There are two holes for each terminal. The hole on the right is the operating hole; the hole on the left is the wire hole.

Insert a flat-blade screwdriver with a width of 2.5 mm into the operating hole and then insert the wiring into the wire hole.

The wire will be clamped when the screwdriver is removed.

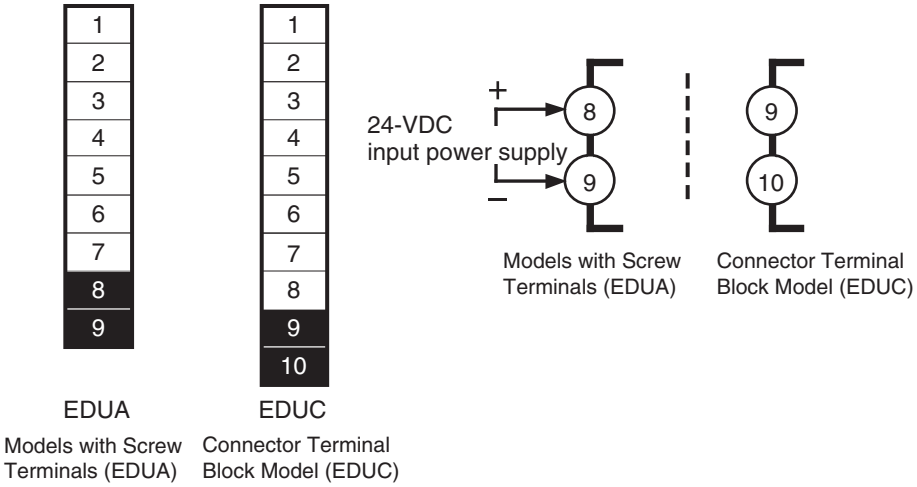
Use pin terminals for wiring that match the cross-sectional area of the wiring material.

We recommend the following pin terminals:
Weidmuller H-sleeve Series

2-2-3 Wiring

Power Supply Voltage

Connect the power supply to models with screw terminals (EDUA) 8 and 9 as shown below. When using a connector terminal block model (EDUC), connect the power supply to terminals 9 and 10.

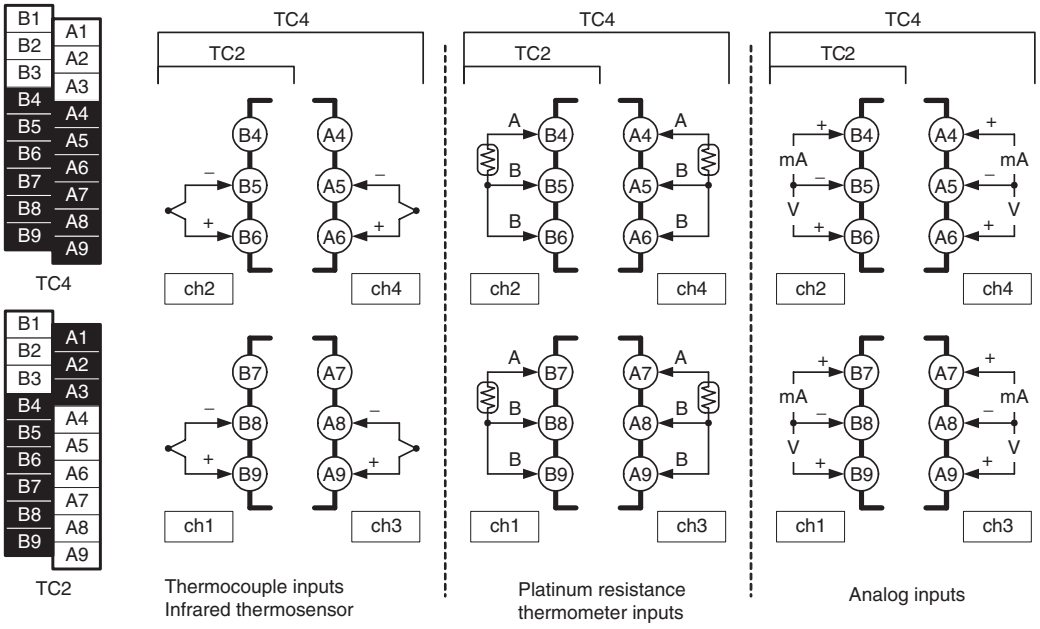


- If reinforced insulation is required, connect the input and output terminals to a device without any exposed current-carrying parts or to a device with standard insulation suitable for the maximum operating voltage of the power supply I/O section.
- Conforming to Safety Standards
  The power supply terminals must be supplied from a SELV, limited-current source. A SELV (separated extra-low voltage) source is a power supply having double or reinforced insulation between the primary and the secondary circuits and having an output voltage of 30 V r.m.s. max. and 42.4 V peak max. or 60 VDC max.
  Recommended power supply: S8VM Series or S8VS Series (both manufactured by OMRON)

  Note Select a power supply that suits the operating environment.
- To comply with the standards for noise terminal voltage for class A in EN 61326, install a noise filter (Densei Lambda MXB-1206-33 or the equivalent) to the DC line as close as possible to the EJ1.

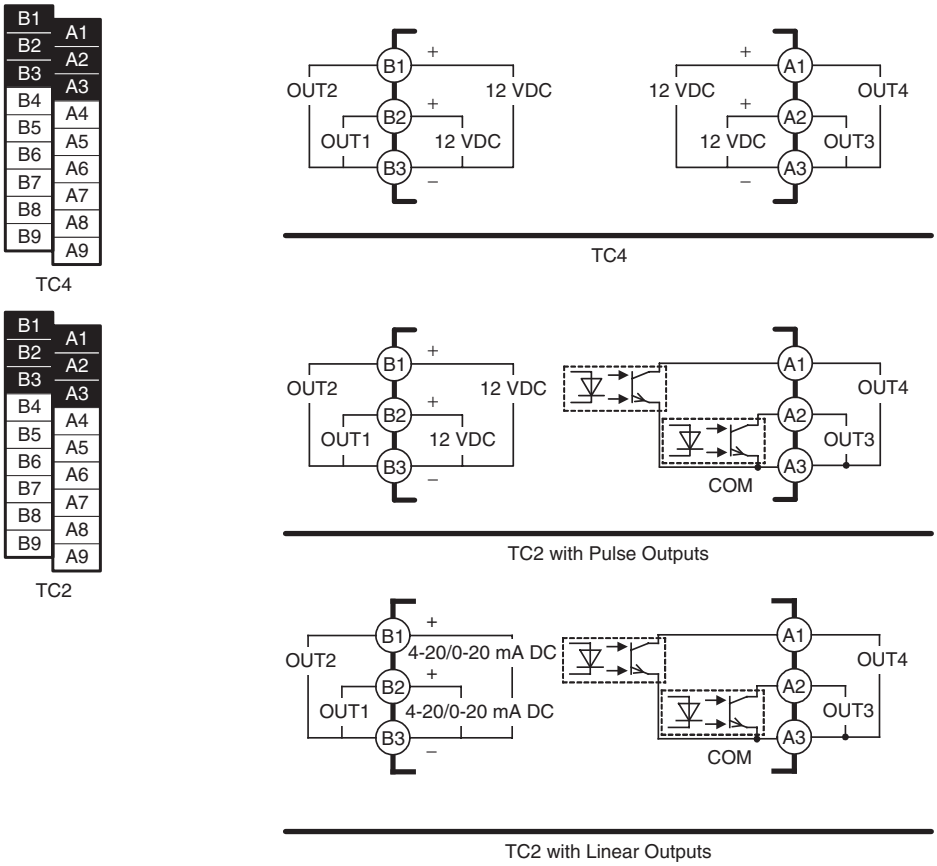
Inputs

Connect inputs according to the input type as shown below.



Control Outputs

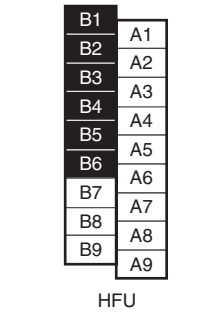
Terminals B1 to B3 and A1 to A3 on the TC4/TC2 are for control outputs.

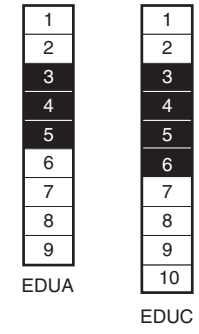


Output type	Specifications
Pulse voltage outputs	Output voltage: 12 VDC ±15% (PNP) Max. load current: 21 mA, with short circuit protection circuit.
Transistor outputs	Max. applicable voltage: 30 VDC Max. load current: 100 mA Residual voltage: 1.5 V max., Leakage current: 0.4 mA max.
Current outputs	Current output range: 4 to 20 mA (resolution: approx. 2,800) 0 to 20 mA (resolution: approx. 3,500) Load: 500 Ω max.

Auxiliary Outputs

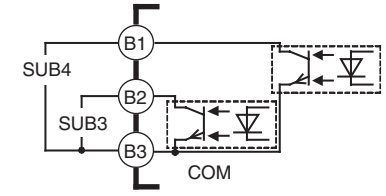
Auxiliary outputs are sent from pins B1 to B6 with the HFU, and from pins 3 to 5 with the EDUA. When using an EDUC, auxiliary outputs are sent from pins 3 to 6.

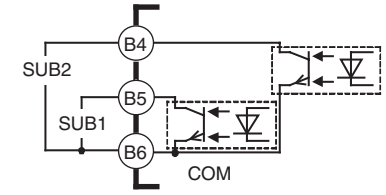




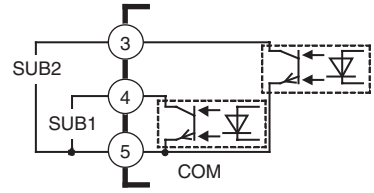
Models with Screw Terminals (EDUA)

Connector Terminal Block Model (EDUC)

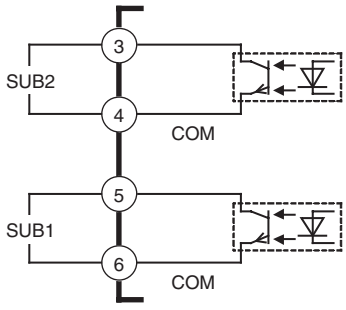




HFU



Models with Screw Terminals (EDUA)



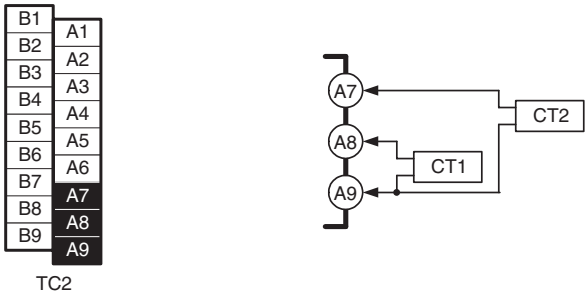
Connector Terminal Block Model (EDUC)

EDU

Output type	Specifications
Transistor outputs	Max. operating voltage: 30 VDC Max. load current: 50 mA Residual voltage: 1.5 V max., leakage current: 0.4 mA max.

CT Inputs (Only Controllers with Pulse Outputs)

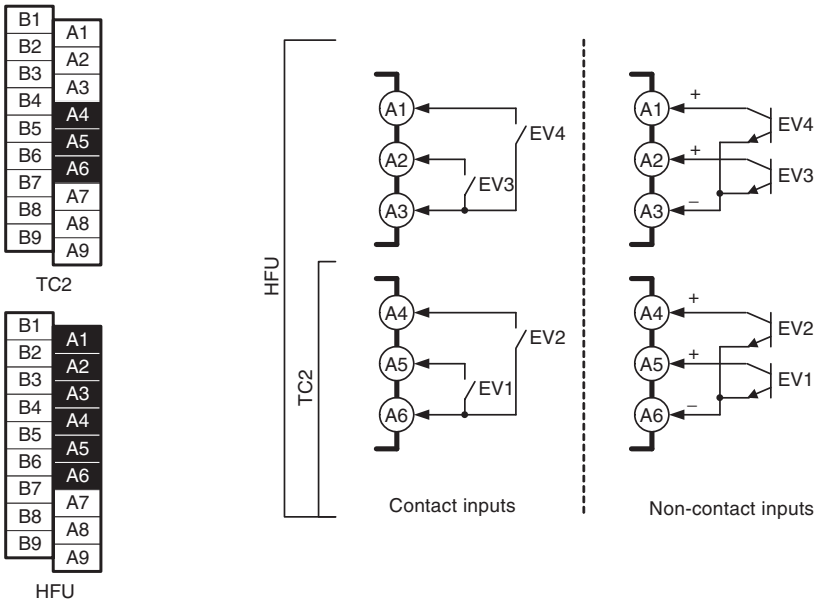
When the heater burnout (HB), heater overcurrent (OC), or heater short (HS) alarm is to be used, connect a Current Transformer (CT) across terminals A8 and A9 or terminals A7 and A9 (no polarity) on the TC2.



- Use a E54-CT1 or E54-CT3 Current Transformer.

Event Inputs

Connect event inputs across terminals A4 and A6 for the TC2 and terminals A1 and A6 for the HFU.

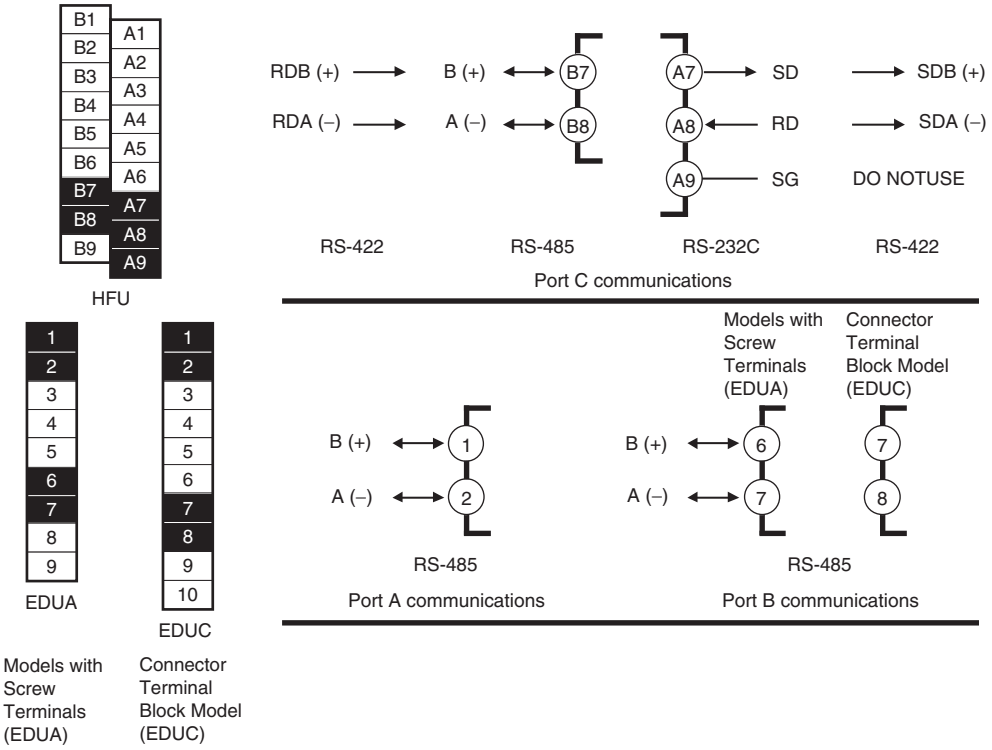


- The inflow current is approximately 4 mA.
- Use event inputs under the following conditions:

Contact inputs	ON: 1 kΩ max., OFF: 100 kΩ min.
Non-contact inputs	ON: Residual voltage: 1.5 V max., OFF: Leakage current: 0.1 mA max.

Communications

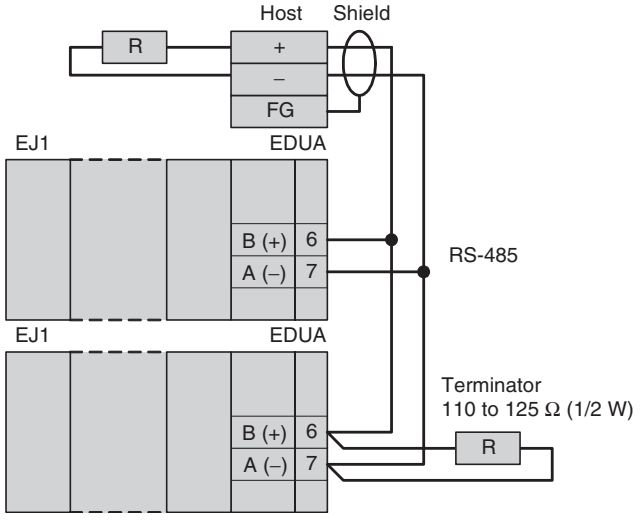
- For communications with the host, connect communications across terminals B7 and B8 or terminals A7 to A9 on the HFU or connect across terminals 1 and 2 or terminals 6 and 7 on the EDU. When using a connector terminal block model, connect communications across terminals 7 and 8.



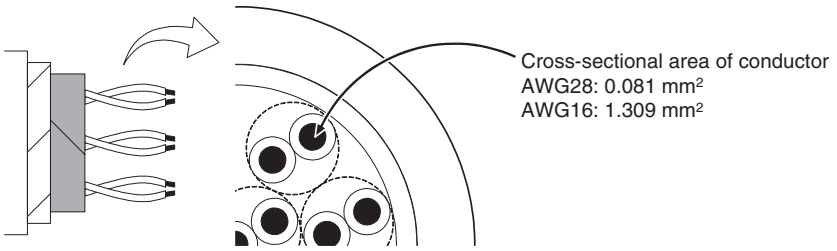
Note

- If there are problems with communications noise performance when using the port A connector, connect 110 to 125 Ω of terminating resistance across terminals 1 and 2 of port A on the EDU.
- Specify both ends of the transmission path, including the host computer, as end nodes (i.e., connect terminators to both end). The minimum terminating resistance is 54 Ω.

■ Connection Example

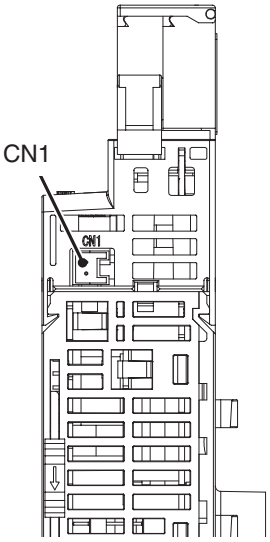


- The RS-485 connection can be either 1: 1 or 1: N. RS-232C connections can only be 1: 1. A maximum of 64 Units (including the host) can be connected in 1: N systems. The maximum total cable length is 500 m. Use AWG28 (cross-sectional area: 0.081 mm^2) to AWG16 (cross-sectional area: 1.309 mm^2) shielded twisted-pair cable.

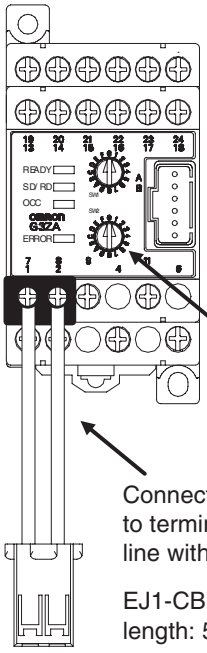


Connecting to the G3ZA Multi-channel Power Controller or G3PW Power Controller

Connecting to the G3ZA Power Controller



Connect the G3ZA Connecting Cable to the CN1 connector on the bottom of the TC Unit.

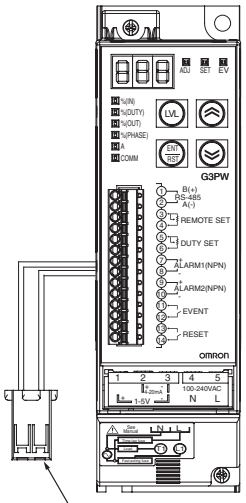


Set SW2 to 3 (57.6 kbps).

Connect the black line with a white stripe to terminal 7 on the G3ZA and the black line with no stripe to terminal 8.

EJ1-CBLA050 (order separately) (cable length: 5 m)

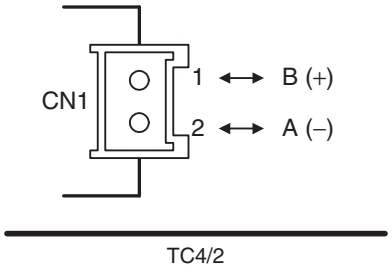
Connecting to the G3PW Power Controller



Set the baud rate to 57.6 kbps (default value) using key operations. For details, refer to the *G3PW Operation Manual*.

Connect the black line with a white stripe to terminal 1 on the G3ZA and the black line with no stripe to terminal 2.

EJ1-CBLA050 (order separately)
(cable length: 5 m)



Use a JST Mfg. Co. Ltd. PA connector.

Housings

Model: PAP-02V-S

Crimp Terminals

Model: SPHD-001T-P0.5

Use an EJ1-CBLA050 Cable (manufactured by OMRON).

The EJ1 contains 120 Ω of terminating resistance. Connect a terminating resistor (110 to 125 Ω, 1/2 W) only to the end G3ZA node.

2-3 Using Tool Ports

Tool ports are used to make EJ1 settings using the EST2-2C-MV□ CX-Thermo Support Software.

The E58-CIFQ1 USB-Serial Conversion Cable is required to make the connection.

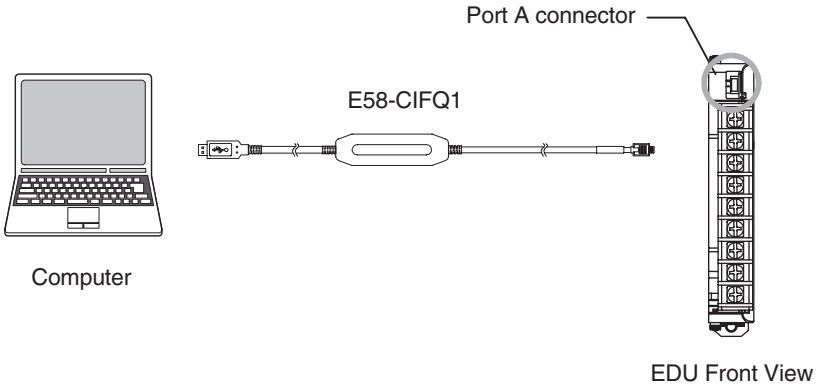
2-3-1 Procedure

1,2,3...

1. Turn ON the power to the EJ1.

   Note Do not connect the E58-CIFQ1 when power to the EJ1 is OFF. If the Cable is connected when the power to the EJ1 is OFF, power will be supplied from the computer and impose a load on the internal circuits of the EJ1.

2. Connect the Cable.
   Connect the computer's USB port with the port A connector on the EJ1 using the Cable.



3. Install the driver.
   A driver must be installed to use the Cable.
   - When the Cable is connected with the computer, the OS will detect a new device.
     Follow the installation wizard instructions and install the driver.

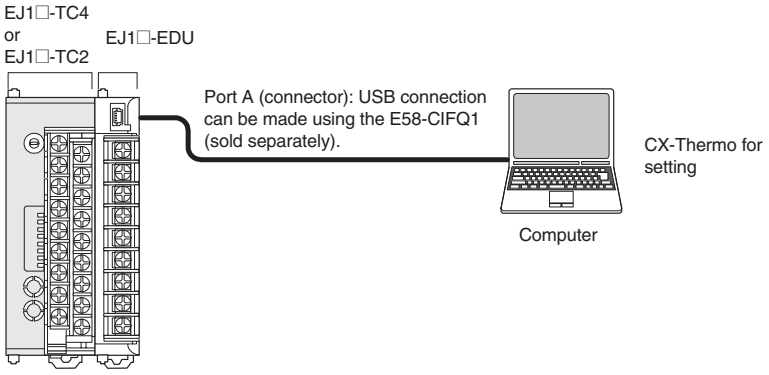
   Note For details on installation methods, refer to the user's manual for the E58-CIFQ1 USB-Serial Conversion Cable.

4. Make the communications port settings.
   The USB-Serial Conversion Cable is used to communicate with the COM port of the computer.
   Set the communications port (COM port) number to be used for the CX-Thermo Support Software to the COM port assigned to the Cable.

2-4 Unit Configuration Examples

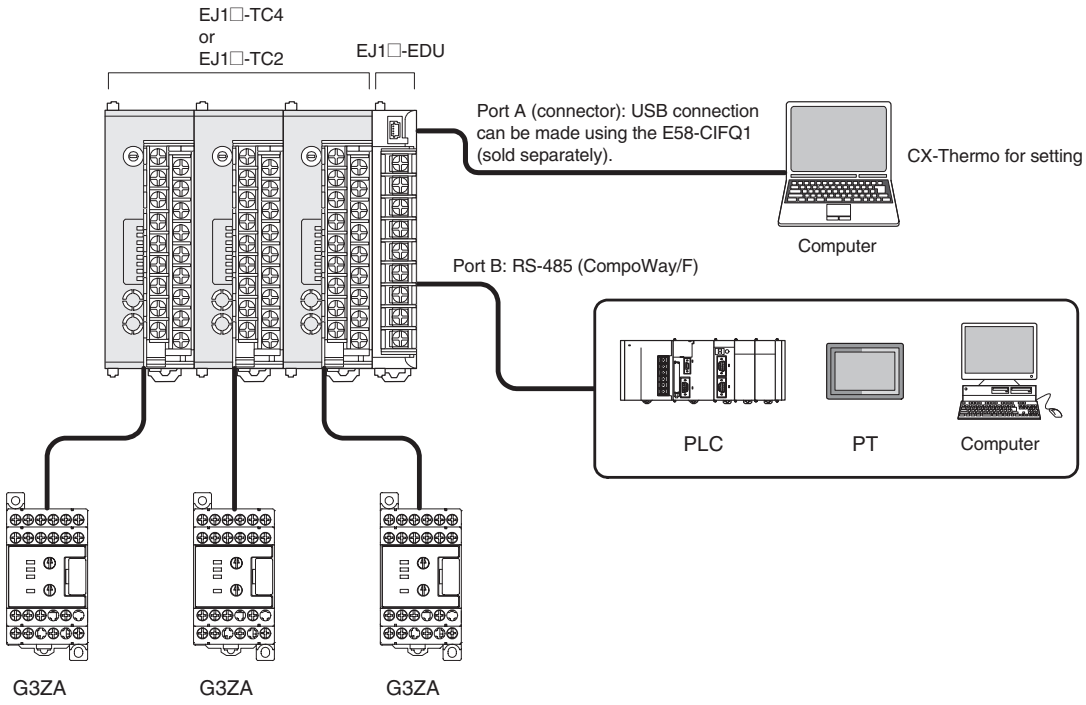
Minimal Configuration

- The two auxiliary alarm outputs (transistor outputs) provided on the End Unit can be used.
- The G3ZA or G3PW can be connected.



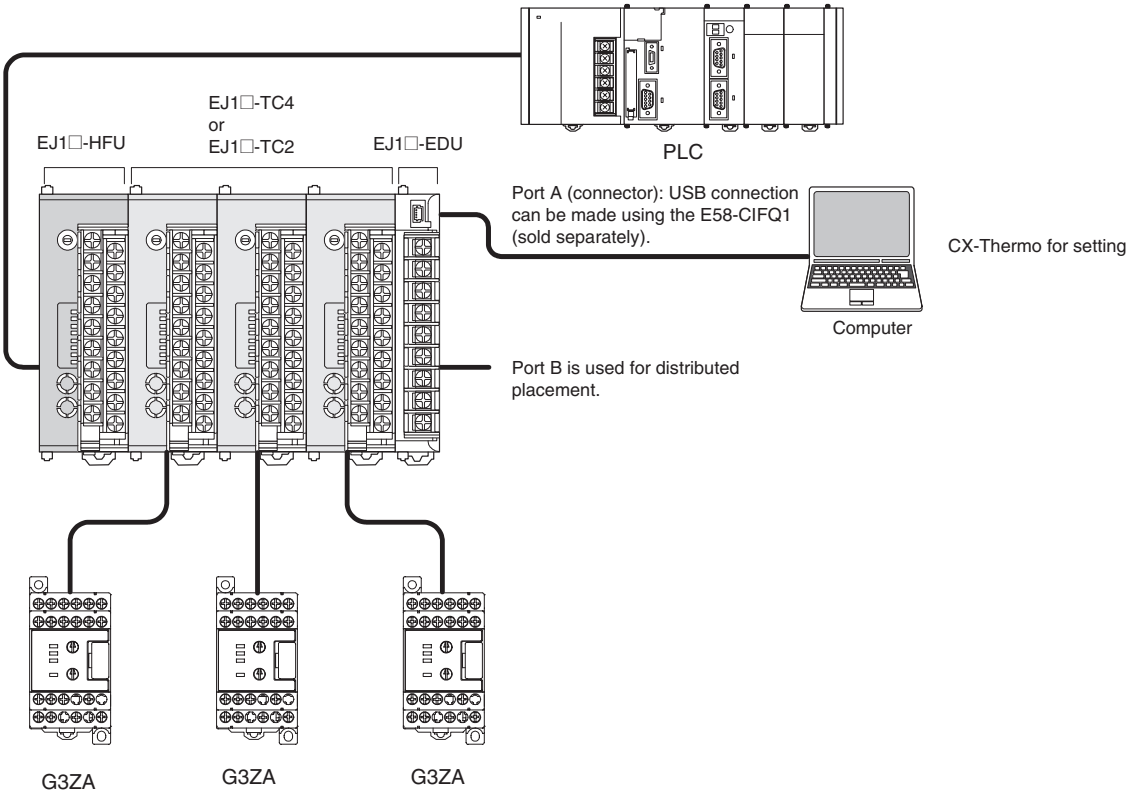
Multiple Units without an HFU

- The two auxiliary alarm outputs (transistor outputs) provided on the End Unit can be used.
- G3ZA or G3PW outputs can be used.
- Distributed placement is possible by using multiple End Units.



Multiple Units with an HFU

- The two auxiliary alarm outputs (transistor outputs) provided on the End Unit can be used.
- In addition to the two auxiliary alarm outputs provided on the End Unit, the four event inputs and four transistor outputs on the HFU can be used.
- G3ZA or G3PW outputs can be used.
- Distributed placement is possible by using multiple End Units.



2-4-1 Connection Precautions

Restrictions on the Number of Units that Can Be Connected

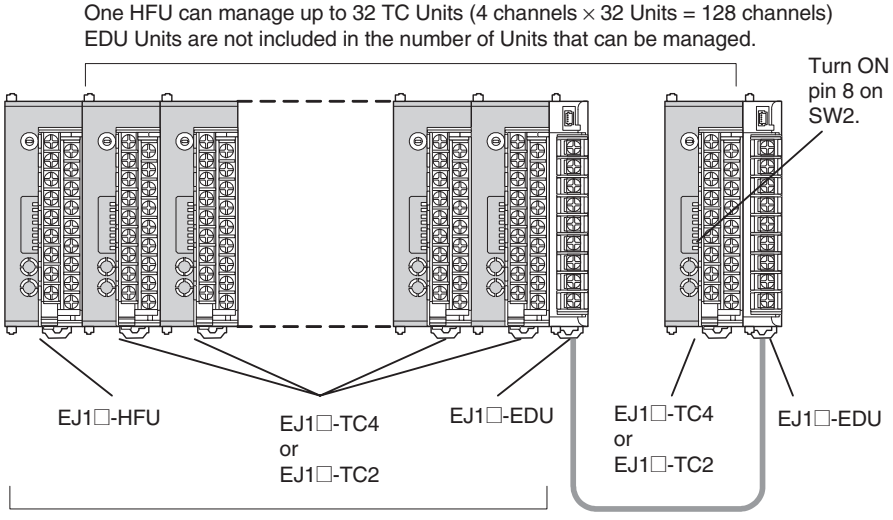
- Unit numbers 0 to 63 can be used for EJ1-HFU and EJ1-TC4/TC2 Units.
- Up to 16 Units, including the HFU, can be connected side by side.

Note EDU Units are not counted in the number of Units that can be connected.

Precautions When Using an HFU

- One HFU can control up to 16 TC4/TC2 Units. With version **V1.2**, one HFU can control up to 32 TC4/TC2 Units.
- The unit numbers of the TC4/TC2 Units can be set to between 0 and 31.
- To connect 16 or more TC4/TC2 Units, Communications Cables must be used to distribute Unit positioning because the maximum number of Units that can be connected horizontally will be exceeded.
- When using Communications Cables to distribute TC4/TC2 Unit positioning, connect the cables to port B on the End Units.
- If distributed positioning is used for an EJ1, power must be supplied separately to the terminal block on the End Units.

Note When using distributed positioning, turn ON power to the distributed Units first or turn ON power to the HFU and distributed Units simultaneously. Even if this is done, there may still be problems with the startup timing depending on the EJ1 configuration and power supply capacity. If problems occur at startup, increase the delay between turning ON the power to the distributed Units and the HFU.


One HFU can manage up to 32 TC Units (4 channels × 32 Units = 128 channels)
EDU Units are not included in the number of Units that can be managed.
Turn ON pin 8 on SW2.
EJ1□-HFU
EJ1□-TC4 or EJ1□-TC2
EJ1□-EDU
EJ1□-TC4 or EJ1□-TC2
EJ1□-EDU
Up to 16 Units can be connected side by side.
EDU Units are not counted in the number of Units that can be connected.

Precautions when Not Using an HFU

- Up to 16 TC4/TC2 Units can be connected horizontally to one End Unit. If End Units are connected with Communications Cables for distributed position, then up to 64 Basic Units can be connected to one host device.

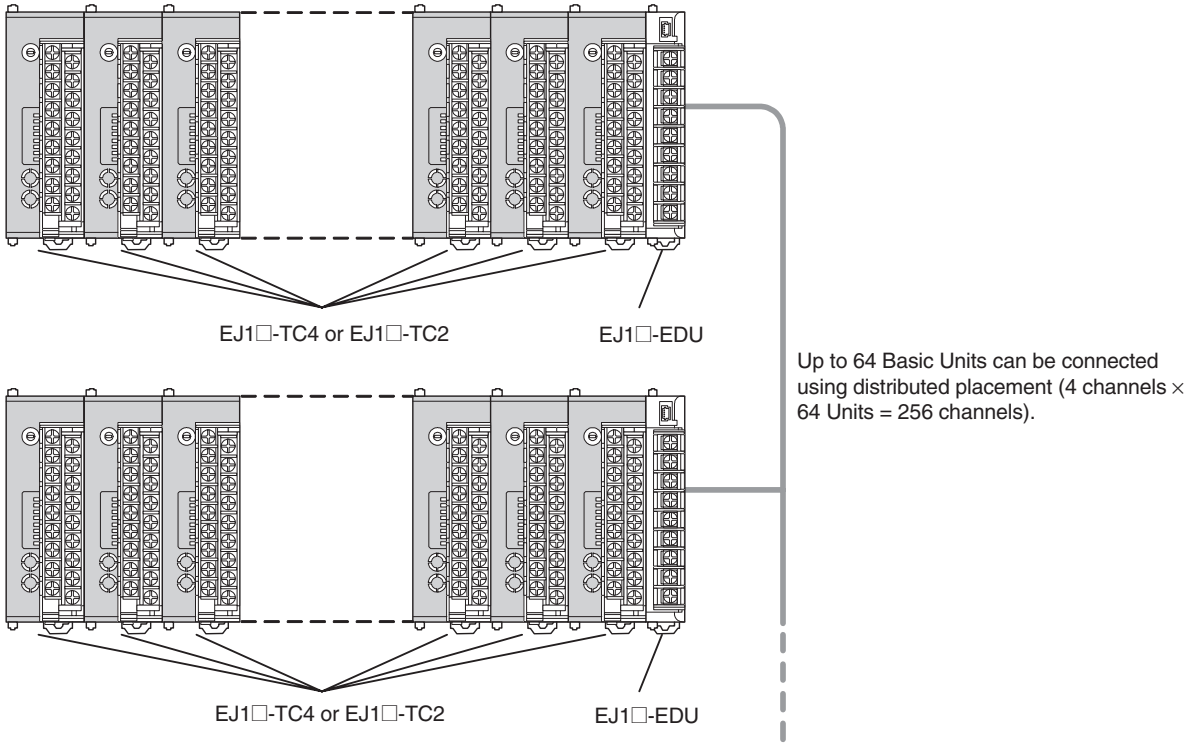
Note

(1) The host device and End Units are not counted when calculating the limit of 64 Basic Units.

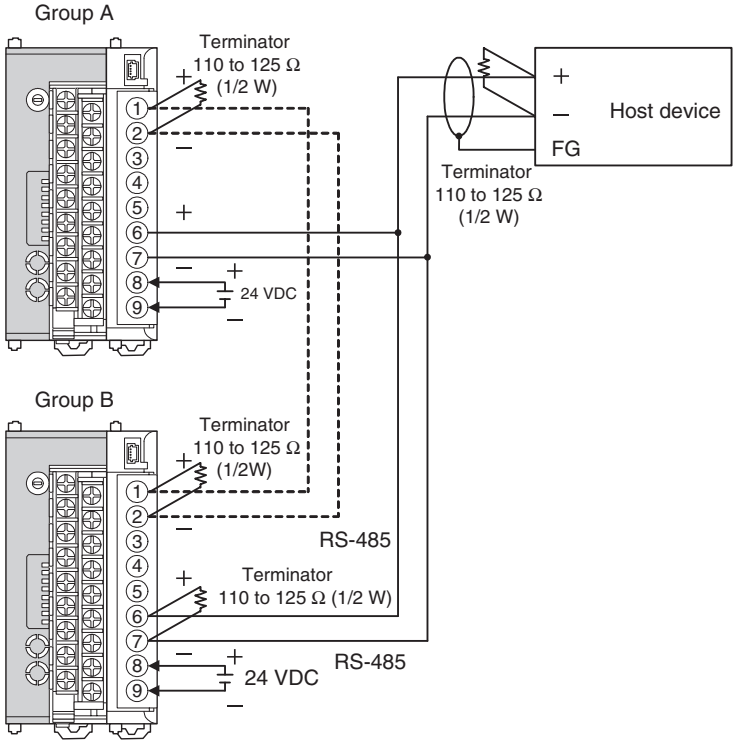
(2) Set the unit numbers of the Basic Units to between 0 and 63. Be sure not to set the same number for more than one Basic Unit.

- If distributed positioning is used for an EJ1, power must be supplied separately to the terminal block on the End Units.

- When using distributed position, connect like ports on the End Units.
- If port A on the terminal blocks is connected for distributed position, then the port A connector can be connected to a computer using an E58-CIFQ1 USB-Serial Conversion Cable to use the CX-Thermo to set the parameters for the distributed EJ1.


EJ1□-TC4 or EJ1□-TC2
EJ1□-EDU
EJ1□-TC4 or EJ1□-TC2
EJ1□-EDU
Up to 64 Basic Units can be connected using distributed placement (4 channels × 64 Units = 256 channels).

Wiring for Distributed Placement

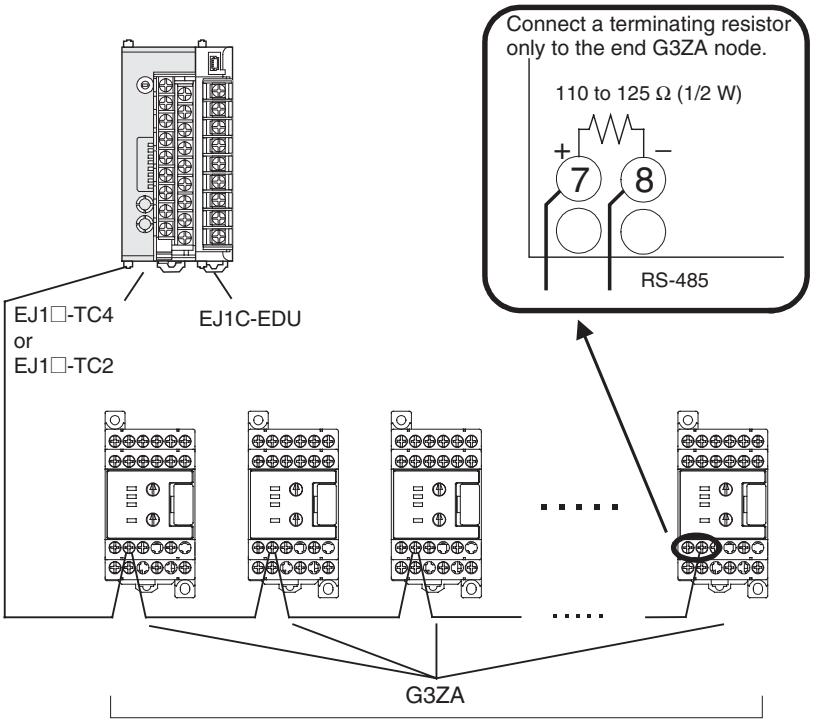


Note Wire the connections indicated with dotted lines when settings for all EJ1 Controllers are being made from one port A connector. If the connections indicated with dotted lines are not wired, the settings for group A can be made only using the port A connector for group A and the settings for group B can be made only using the port A connector for group B.

Connecting the G3ZA or G3PW to the EJ1

- Up to 8 G3ZA Multi-channel Power Controllers or G3PW Power Controllers can be connected to one TC4/TC2 Unit. However, the G3ZA and G3PW cannot be used together.

Note Either turn ON the power to the G3ZA or G3PW first, or turn ON the power to the G3ZA or G3PW simultaneously with the EJ1.

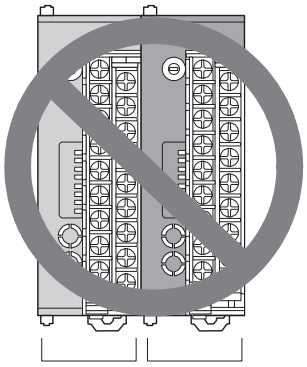


Up to 8 G3ZA Power Controllers can be connected to one TC Unit.

Restrictions on Connections and Placement

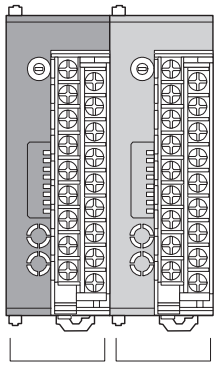
- Always connect the HFU on the left side of the TC4/TC2 Units.

Incorrect



EJ1□-TC4 or EJ1□-TC2 | EJ1□-HFU

Correct



EJ1□-HFU | EJ1□-TC4 or EJ1□-TC2

SECTION 3
Typical Control Examples

This section describes the basic applications of the EJ1 using specific control examples.

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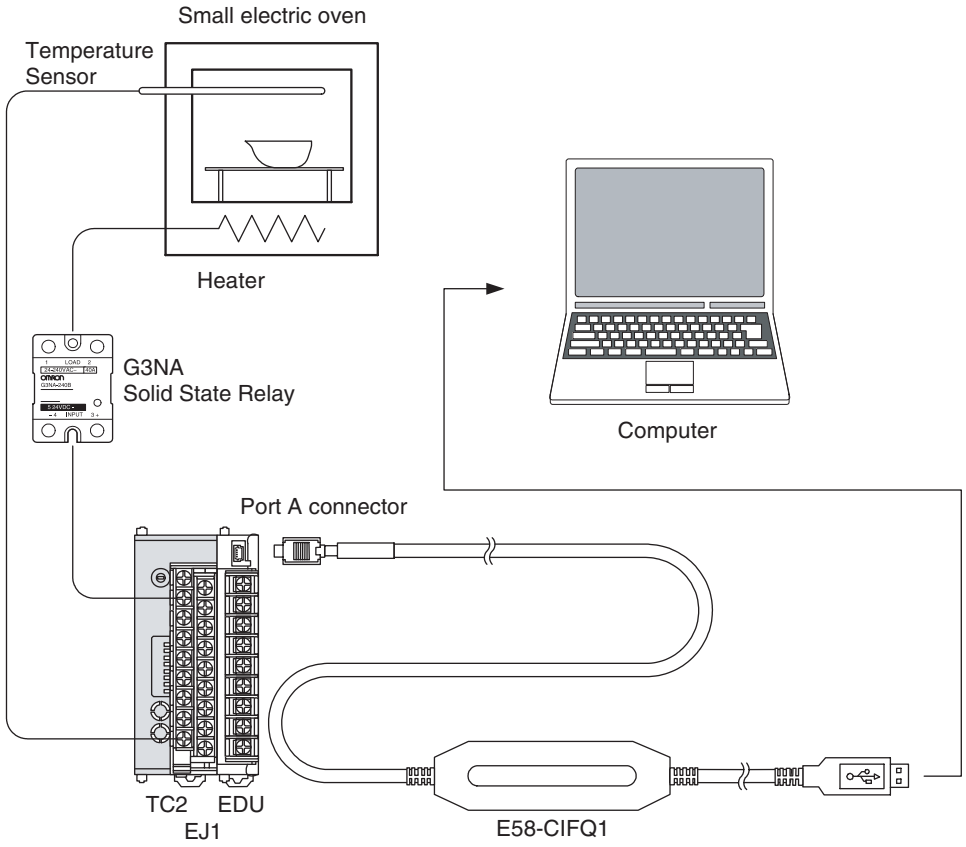
3-1 Minimum Configuration for Control

3-1-1 Application

This section shows an example configuration for a small electric oven and explains how to set up and control the system using the CX-Thermo Support Software.

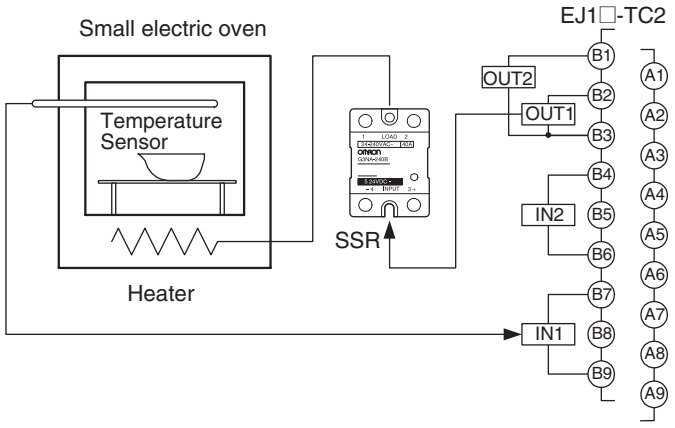


- The CX-Thermo Support Software can be used to set EJ1 parameters from the personal computer.

3-1-2 Wiring

- Connect the Temperature Sensor to the input terminals according to the sensor's input type.
- Connect the Solid State Relay to the output terminals.

When an EJ1□-TC2 is used, wire the circuits as shown below.



3-1-3 Setup

Use the CX-Thermo Support Software to set EJ1 parameters from the personal computer.

Use the following procedure to set the parameters.

1,2,3... 1. Turn ON the power to the EJ1.

Note Do not connect the E58-CIFQ1 when power to the EJ1 is OFF. If the Cable is connected when the power to the EJ1 is OFF, power will be supplied from the computer and impose a load on the internal circuits of the EJ1.

2. Connect the computer's USB port to the port A connector on the EJ1 using the Cable.

Note A driver must be installed to use the Cable.
For details on installation methods, refer to the user's manual for the E58-CIFQ1 USB-Serial Conversion Cable.

3. Connect the CX-Thermo Support Software to set the communications protocol.
Select ***Communications - Settings*** and set the following communications parameters.

Serial port	COM (See note 1.) (E58-CIFQ1 Serial Port)
Baud rate	38400
Data length	7
Stop bits	2
Parity	Even
Unit number	(See note 2.)

Note (1) The serial port (COM port) number depends on the computer's settings.

(2) Verify the unit number, which is set with switches SW1 and SW2 on the EJ1's front panel.

4. The following table shows the related parameter settings for this example.

CX-Thermo Basic Mode Setting Example

	Setting example	Remarks
EJ1N-TC2A-QNHB 0	---	---
CH1		
Control in progress parameters		
Bank 0		
Bank 0 Set Point - CH1	150°C	
Bank 0 Proportional Band - CH1	8.0°C	Default
Bank 0 Integral Time - CH1	233 s	Default
Bank 0 Derivative Time - CH1	40.0 s	Default
Bank 0 Alarm Value 1 - CH1	0°C	
Bank 0 Alarm Upper Limit Value 1 - CH1	0°C	Upper limit alarm; not used.
Bank 0 Alarm Lower Limit Value 1 - CH1	0°C	Upper limit alarm; not used.
Bank 0 Alarm Value 2 - CH1	0°C	
Bank 0 Alarm Upper Limit Value 2 - CH1	0°C	Upper limit alarm; not used.
Bank 0 Alarm Lower Limit Value 2 - CH1	0°C	Upper limit alarm; not used.
Adjustment settings		
Manual MV - CH1	0.0%	Disabled in Auto mode
HB/HS/OC settings 1	---	---
Heater Burnout 1 Detection	0.0 A	HB alarm OFF
Heater Burnout 2 Detection	0.0 A	HB alarm OFF
Control stopped parameters	---	---
Input settings		
Input Type - CH1	5: Thermocouple (K)	
Temperature Unit - CH1	°C	
Output settings	---	---
Control Period 1	2	OUT1 control period: 2 s
Alarm settings	---	---
Alarm 1 Type - CH1	2: Upper-limit alarm	
Alarm 2 Type - CH1	2: Upper-limit alarm	
Operation commands	---	---
RUN - CH1		
STOP - CH1		
Manual - CH1		
Auto - CH1		
100% AT Execute - CH1		
AT Cancel - CH1		

3-1-4 Adjustment

Execute autotuning (AT) to make the PID adjustments.

If self-tuning (ST) is activated, the PID will be automatically calculated when using standard control. **V1.2**

Refer to *4-3-8 Tuning*.

When the CX-Thermo Support Software is being used, both EJ1 control and autotuning can be started/stopped using operation commands.

Special Remarks

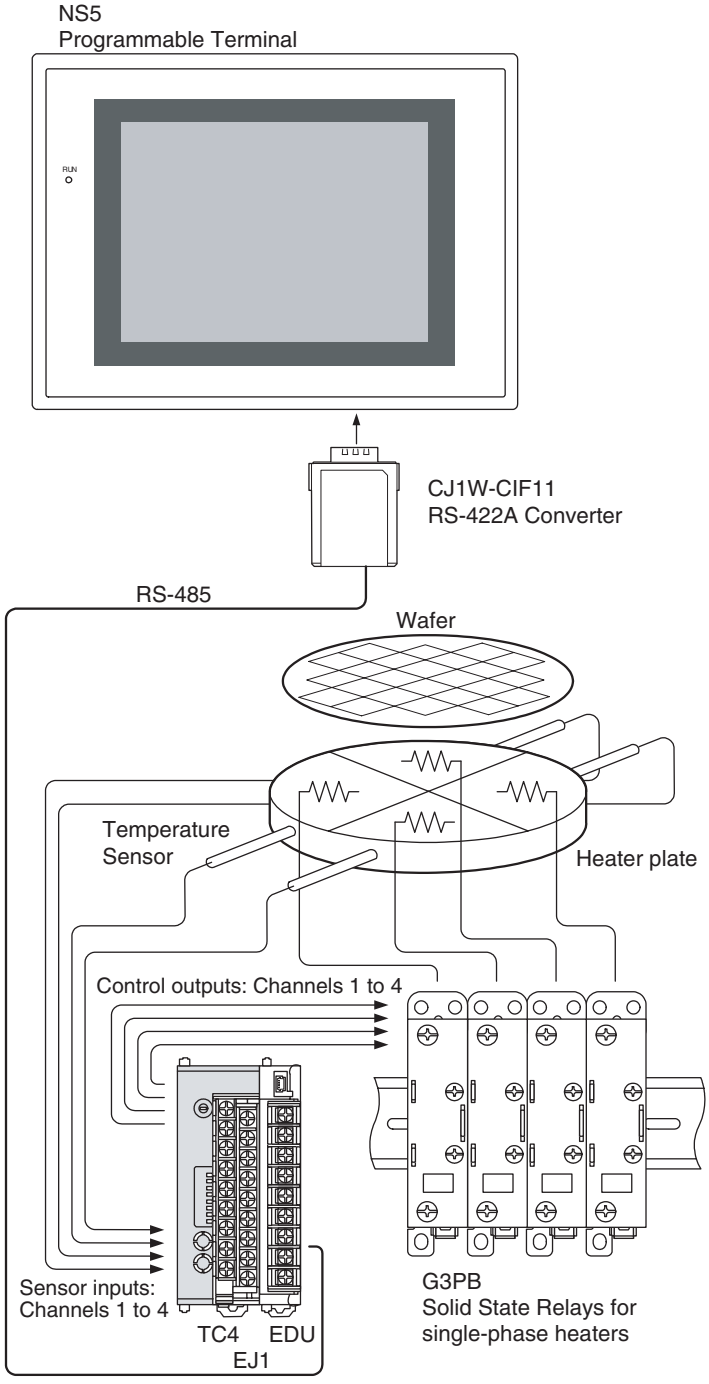
The CX-Thermo Support Software starts in Basic Mode by default. If you want to set parameters that are not displayed in Basic Mode, select *View - View Mode* and switch to Advanced Mode to enable the advanced settings.

In addition, the View Mode can be set to level group display, or functional group display. When functional group display is selected, items are grouped by function rather than displayed separately as they are in the level group display mode.

3-2 Multi-channel Control

3-2-1 Application

In this example configuration, an EJ1 controls a 4-zone heater plate.



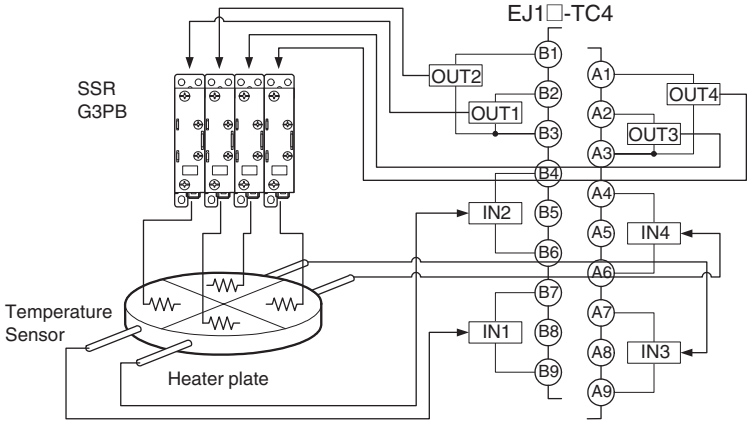
- A single Temperature Controller can handle the 4-zone control if a 4-channel Basic Unit (EJ1□-TC4) is used. Up to 16 Basic Units can be connected to one EJ1C-EDU End Unit to expand to a maximum of 64 channels.
  Also, the Temperature Controller's settings, operation, and monitoring can be performed from a Programmable Terminal (without creating a communications program) by using Smart Active Parts (SAP).

3-2-2 Wiring

Connect the Temperature Sensor to the input terminals according to the sensor's input type.

Connect the Solid State Relays for zones 1, 2, 3, and 4 to output terminals OUT1, OUT2, OUT3, and OUT4, respectively.

When an EJ1□-TC4 is used, wire the circuits as shown below.



3-2-3 Setup

The settings are made through communications. The CX-Thermo Support Software can be connected using an E58-CIFQ1 Connecting Cable to set the parameters from a personal computer.

The following table shows the related parameter settings for this example.

Related parameters	Description
CH1 - Input Type (Variable type E0, Address 0100)	0006: K –20.0 to 500.0°C
CH2 - Input Type (Variable type E0, Address 0200)	0006: K –20.0 to 500.0°C
CH3 - Input Type (Variable type E0, Address 0300)	0006: K –20.0 to 500.0°C
CH4 - Input Type (Variable type E0, Address 0400)	0006: K –20.0 to 500.0°C
OUT1 - Control Output 1 Assignment (Variable type E1, Address 0100)	002F: Channel 1 MV (heating)
OUT2 - Control Output 2 Assignment (Variable type E1, Address 0200)	004F: Channel 2 MV (heating)
OUT3 - Control Output 3 Assignment (Variable type E1, Address 0300)	006F: Channel 3 MV (heating)
OUT4 - Control Output 4 Assignment (Variable type E1, Address 0400)	008F: Channel 4 MV (heating)
CH1 - Direct/Reverse Operation (Variable type E5, Address 0100)	0000: Reverse (default)
CH2 - Direct/Reverse Operation (Variable type E5, Address 0200)	0000: Reverse (default)
CH3 - Direct/Reverse Operation (Variable type E5, Address 0300)	0000: Reverse (default)
CH4 - Direct/Reverse Operation (Variable type E5, Address 0400)	0000: Reverse (default)
CH1 - PID/OnOff (Variable type E5, Address 0106)	0000: 2-PID (default)
CH2 - PID/OnOff (Variable type E5, Address 0206)	0000: 2-PID (default)
CH3 - PID/OnOff (Variable type E5, Address 0306)	0000: 2-PID (default)
CH4 - PID/OnOff (Variable type E5, Address 0406)	0000: 2-PID (default)
CH1 - Output Mode Selection (Variable type E5, Address 0107)	0000: Standard control (default)
CH2 - Output Mode Selection (Variable type E5, Address 0207)	0000: Standard control (default)
CH3 - Output Mode Selection (Variable type E5, Address 0307)	0000: Standard control (default)
CH4 - Output Mode Selection (Variable type E5, Address 0407)	0000: Standard control (default)
CH1 - Set Point (Variable type D4, Address 0100)	047E: 115.0°C
CH2 - Set Point (Variable type D4, Address 0200)	047E: 115. 0°C

Related parameters	Description
CH3 - Set Point (Variable type D4, Address 0300)	047E: 115. 0°C
CH4 - Set Point (Variable type D4, Address 0400)	047E: 115. 0°C
CH1 - Control Period 1 (Variable type E1, Address 0101)	0000: 0.5 s
CH2 - Control Period 2 (Variable type E1, Address 0201)	0000: 0.5 s
CH3 - Control Period 3 (Variable type E1, Address 0301)	0000: 0.5 s
CH4 - Control Period 4 (Variable type E1, Address 0401)	0000: 0.5 s

Note
- Connect the PT to port B.
- Set the write mode to backup mode.
- Set the PT's communications parameters the same as the port B communications parameters.

3-2-4 Adjustment

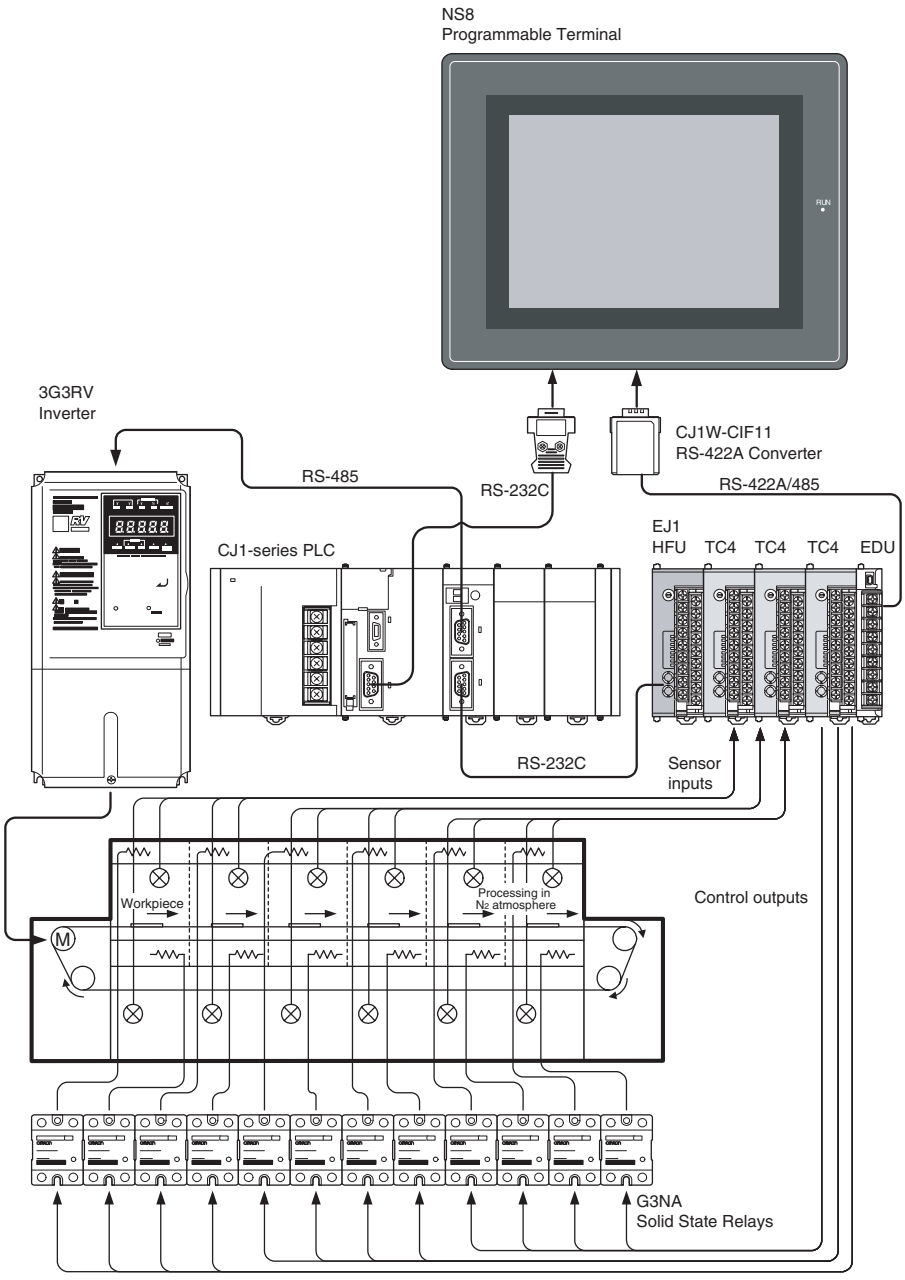
Execute autotuning (AT) to make the PID adjustments.
If self-tuning (ST) is activated, the PID will be automatically calculated when using standard control. **V1.2**

Refer to *4-3-8 Tuning* for details.

3-3 Control Linked to a Host Device

3-3-1 Application

In this example configuration, a CJ1-series PLC controls a reflow oven and an EJ1 performs temperature control on 6 zones and 12 control loops in the oven.



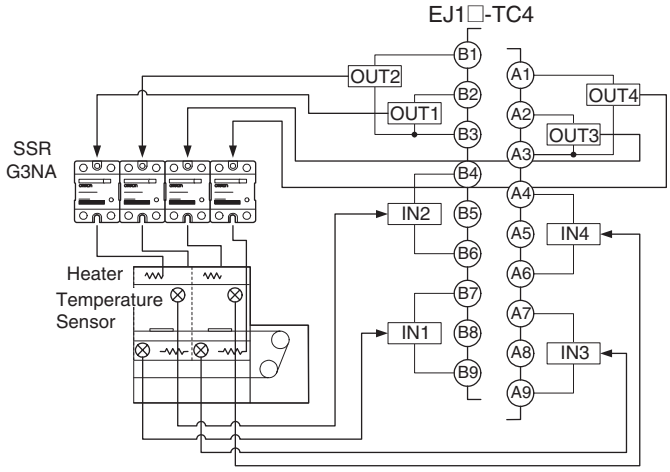
- If an EJ1□-HFU is used, a ladder program does not have to be created to exchange data such as temperature readings and alarm status with the PLC.
  Also, up to 16 Basic Units can be connected to a single HFU to expand the system to a maximum of 64 channels. When using version **V1.2**, 32 Basic Units can be connected to a single HFU to expand the system to a maximum of 128 channels.

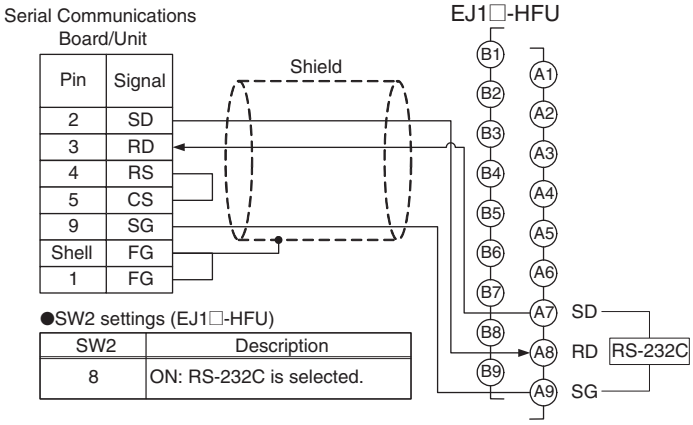
3-3-2 Wiring

Connect the Temperature Sensors to the input terminals according to the sensor's input type.

- Connect the Solid State Relays to the output terminals.
- Connect the PLC with an RS-232C communications cable.

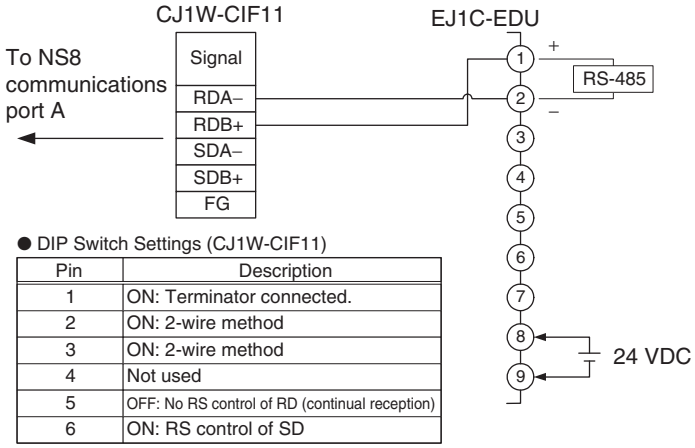
Wire the circuits as shown below when using an EJ1□-HFU and three EJ1□-TC4 Units.
(The following diagram shows the wiring for just one of the EJ1□-TC4 Units.)





●SW2 settings (EJ1□-HFU)

SW2	Description
8	ON: RS-232C is selected.



● DIP Switch Settings (CJ1W-CIF11)

Pin	Description
1	ON: Terminator connected.
2	ON: 2-wire method
3	ON: 2-wire method
4	Not used
5	OFF: No RS control of RD (continual reception)
6	ON: RS control of SD

Note Port B cannot be used when the HFU (EJ1□-HFU) is used.

3-3-3 Setup

TC4

Refer to *3-2 Multi-channel Control* for details on the EJ1□-TC4 settings.

HFU

The settings are made through communications. The CX-Thermo Support Software can be connected using an E58-CIFQ1 Connecting Cable to set the parameters from a personal computer.

- The following table shows the parameters related to communications between the EJ1 and PLC, as well as example settings. Set the unit number of the HFU to 0.

Parameter			Set value	Remarks
Initial setting level				
	Port C Communications Baud Rate		115.2 (kbps)	Default
		Port C Communications Data Length (See note 1.)	8 (bit)	Default
		Port C Communications Parity (See note 1.)	Even	Default
		Port C Communications Stop Bits (See note 1.)	1 (bit)	Default
Programless				
	Common settings			
		Programless Communications Protocol	NT Link (1: N)	Default
		Programless Communications Upload Data Area (See note 1.)	DM	Default
		Programless Communications Download Data Area (See note 1.)	DM	Default
		Programless Communications Upload Start Address (See note 1.)	0	Default
		Programless Communications Download Start Address (See note 1.)	1500	Default
	Upload settings			
		Programless Upload Settings 4	Unit No. 1 - Common - Device A Status	
		Programless Upload Settings 5	Unit No. 1 - CH1 - Process Value	
		Programless Upload Settings 6	Unit No. 1 - CH2 - Process Value	
		Programless Upload Settings 7	Unit No. 1 - CH3 - Process Value	
		Programless Upload Settings 8	Unit No. 1 - CH4 - Process Value	
		Programless Upload Settings 9	Unit No. 2 - Common - Device A Status	
		Programless Upload Settings 10	Unit No. 2 - CH1 - Process Value	
		Programless Upload Settings 11	Unit No. 2 - CH2 - Process Value	
		Programless Upload Settings 12	Unit No. 2 - CH3 - Process Value	
		Programless Upload Settings 13	Unit No. 2 - CH4 - Process Value	
		Programless Upload Settings 14	Unit No. 3 - Common - Device A Status	
		Programless Upload Settings 15	Unit No. 3 - CH1 - Process Value	
		Programless Upload Settings 16	Unit No. 3 - CH2 - Process Value	
		Programless Upload Settings 17	Unit No. 3 - CH3 - Process Value	
		Programless Upload Settings 18	Unit No. 3 - CH4 - Process Value	
		Programless Upload Settings 19	Unit No. 0 - Common - End Code	
		⋮	⋮	
	Download settings			
		Programless Download Settings 4	Unit No. 1 - CH1 - Set Point	
		Programless Download Settings 5	Unit No. 1 - CH2 - Set Point	
		Programless Download Settings 6	Unit No. 1 - CH3 - Set Point	
		Programless Download Settings 7	Unit No. 1 - CH4 - Set Point	
		Programless Download Settings 8	Unit No. 2 - CH1 - Set Point	
		Programless Download Settings 9	Unit No. 2 - CH2 - Set Point	
		Programless Download Settings 10	Unit No. 2 - CH3 - Set Point	
		Programless Download Settings 11	Unit No. 2 - CH4 - Set Point	
		Programless Download Settings 12	Unit No. 3 - CH1 - Set Point	
		Programless Download Settings 13	Unit No. 3 - CH2 - Set Point	
		Programless Download Settings 14	Unit No. 3 - CH3 - Set Point	
		Programless Download Settings 15	Unit No. 3 - CH4 - Set Point	
		Programless Download Settings 16	Unit No. 0 - Common - End Code	
		⋮	⋮	

Note (1) Displayed when the CX-Thermo's **View Mode** is set to **Advanced** Mode.

Note

- The Programmable Terminal and E58-CIFQ1 Connecting Cable cannot be connected at the same time.
- When connecting the cable for the Support Software to an EJ1C-EDU End Unit, either turn OFF the Programmable Terminal's power supply or switch the Programmable Terminal's screen to the system menu.

PLC

The following example settings are for communications with port 2 of a CJ1W-SCU41 Serial Communications Unit.

Port 2: User/custom settings	Custom settings
Port 2: Serial communications mode	NT Link (1: N)
Port 2: Baud rate	High-speed
Port 2: NT Link (1: N) maximum unit number	0

3-3-4 Adjustment

Execute autotuning (AT) to make the PID adjustments.

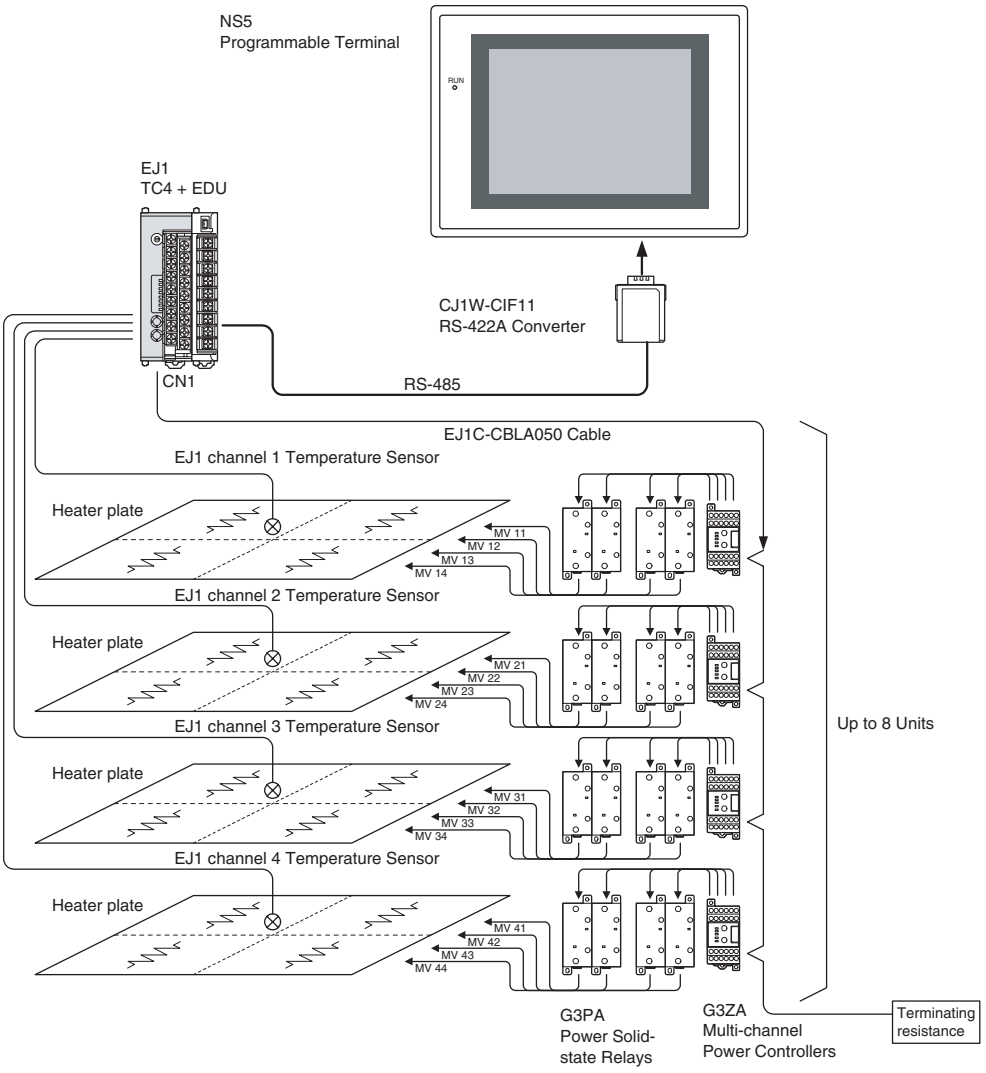
If ST is activated, the PID will be automatically calculated when using standard control. **V1.2**

Refer to *4-3-8 Tuning* for details.

3-4 Controlling G3ZA Controllers Connected to Output Devices

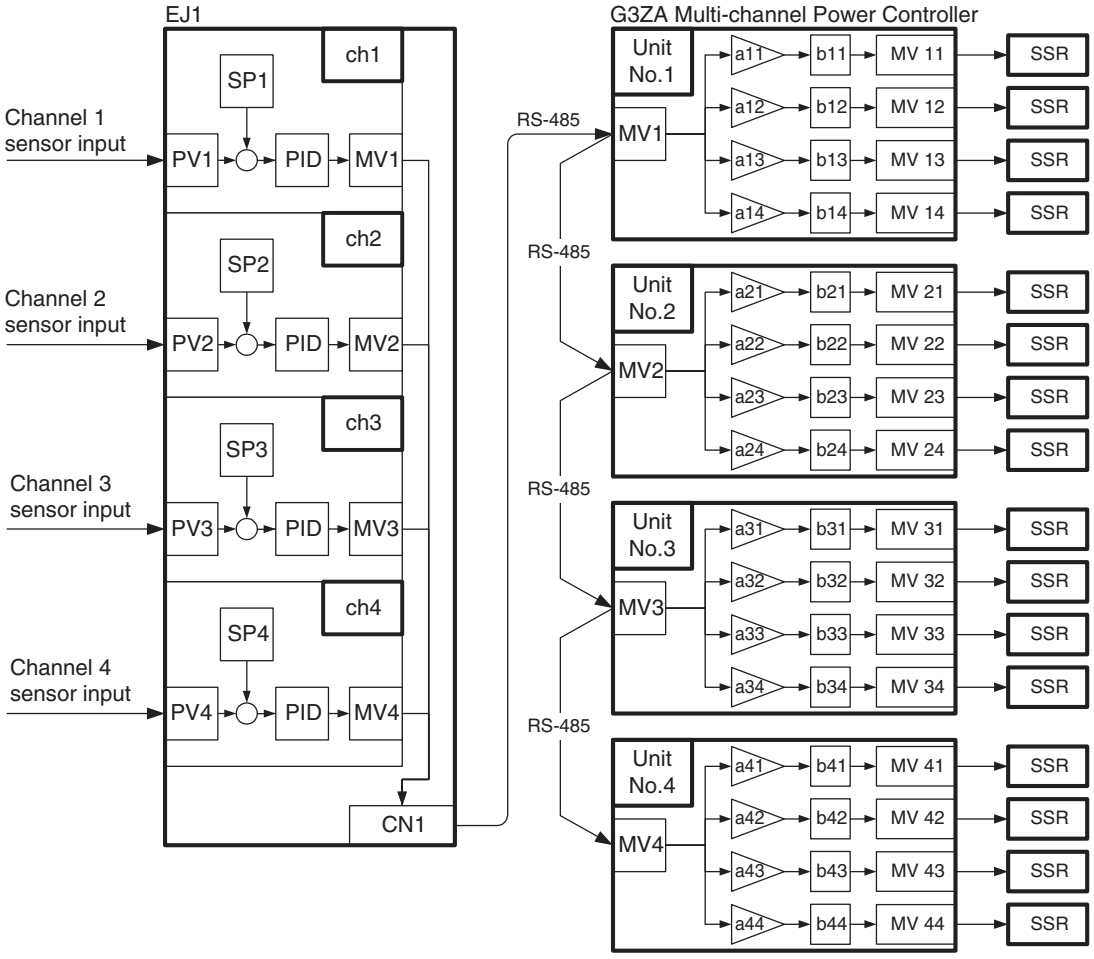
3-4-1 Application

In this example configuration, G3ZA Multi-channel Power Controllers are used to control the temperature in a 4-zone heater plate with a single control loop by applying a fixed coefficient (slope) to the results of the EJ1's PID calculations.



- Up to eight G3ZA Controllers can be connected to the EJ1□-TC4 using the special communications ports. It is not necessary to create a program for communications between the EJ1 and G3ZA.
- Also, the G3ZA's internal parameters can be set to split a single EJ1 channel's control output into 4 branches (with the G3ZA-4H□03-FLK) or 8 branches (with the G3ZA-8A□03-FLK).
- A slope (coefficient) and offset value can be set for each branch output.

Using the G3ZA's MV Calculations for Slope (Gradient) Control



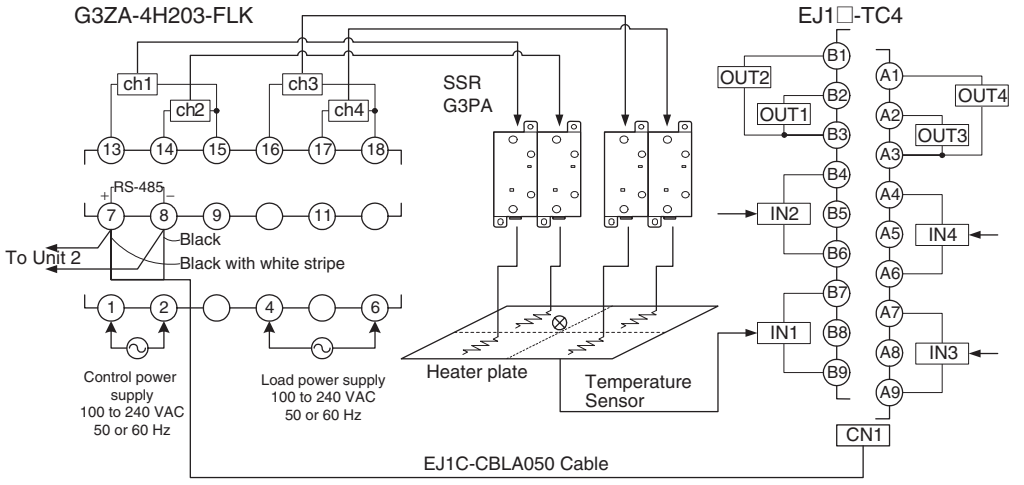
Control value = Source channel MV × Slope (a) + Offset (b)

3-4-2 Wiring

Connect the Temperature Sensors to the input terminals according to the sensor's input type.

- Connect the EJ1 and G3ZA with the EJ1C-CBLA050 Cable.
- Connect the Solid State Relays to the G3ZA's output terminals.

When using an EJ1□-TC4 and G3ZA-4H203-FLK, wire the circuits as shown in the following diagram.



●SW1 settings (G3ZA-4H203-FLK)

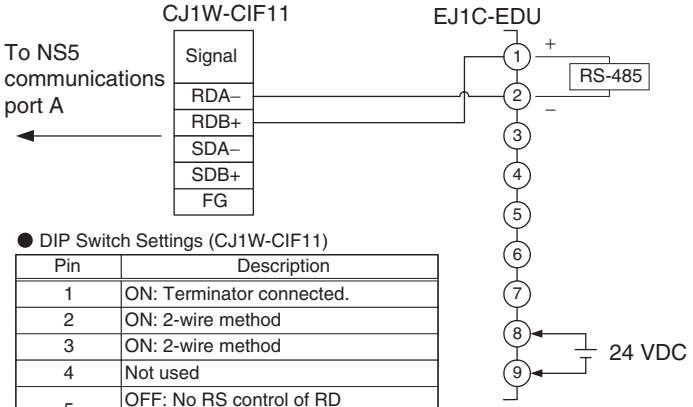
SW1	1	2	3	4
Unit number	01	02	03	04

●SW2 settings (G3ZA-4H203-FLK)

SW2	Description
3	Baud rate: 57.6 kbps

●SW2 settings (EJ1□-TC4)

SW2	Description
7	ON: Use G3ZA



● DIP Switch Settings (CJ1W-CIF11)

Pin	Description
1	ON: Terminator connected.
2	ON: 2-wire method
3	ON: 2-wire method
4	Not used
5	OFF: No RS control of RD (continual reception)
6	ON: RS control of SD

3-4-3 Setup

The settings are made through communications. The CX-Thermo Support Software can be connected using an E58-CIFQ1 Connecting Cable to set the parameters from a personal computer.

The following table shows the parameters related to the G3ZA that can be set from the Temperature Controller, as well as example settings.

Variable type	Address	Parameter name		Set value
DA	0100	G3ZA Unit number 01	CH1 Slope	028A: 65.0%
	0101		CH2 Slope	0288: 64.8%
	0102		CH3 Slope	028F: 65.5%
	0103		CH4 Slope	0280: 64.0%
	0108		CH1 Offset	0032: 5.0%
	0109		CH2 Offset	0032: 5.0%
	010A		CH3 Offset	0032: 5.0%
	010B		CH4 Offset	0032: 5.0%
	0110		CH1 Source Channel	0001: Channel 1
	0111		CH2 Source Channel	0001: Channel 1
	0112		CH3 Source Channel	0001: Channel 1
	0113		CH4 Source Channel	0001: Channel 1
	0124		Offset control	0001: Enabled
	0200	G3ZA Unit number 02	Same as G3ZA Unit number 01	
	0300	G3ZA Unit number 03		
	0400	G3ZA Unit number 04		

Note

- The Programmable Terminal and E58-CIFQ1 Connecting Cable cannot be connected at the same time.
- When connecting the cable for the Support Software to an EJ1C-EDU End Unit, either turn OFF the Programmable Terminal's power supply or switch the Programmable Terminal's screen to the system menu.

3-4-4 Adjustment

Execute autotuning (AT) to make the PID adjustments.

If ST is activated, the PID will be automatically calculated when using standard control. **V1.2**

Refer to *4-3-8 Tuning* for details.

Set the slope and offset values independently to match the system. (The default value for the slope is 100.0% and the default value for the offset is 0.0%.)

SECTION 4
Basic Units (TC4 and TC2) Functions

This section describes the functions of EJ1 Basic Units.

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4-1 Setting Input Specifications

4-1-1 Input Type

Set the input type to match the type of sensor being used.

Variable type	Parameter name	Setting range	Default
E0/A0	Input Type (Channel)	0 to 29 0 to 30 **V1.2**	5

Conditions for use	No special conditions

Note This parameter can be set only when operation is stopped.

List of Input Types

Input type		Specification	Set value	Setting range	
				(°C)	(°F)
Temperature input	Platinum resistance thermometer	Pt100	0	–200 to 850	–300 to 1500
			1	–199.9 to 500.0	–199.9 to 900.0
			2	0.0 to 100.0	0.0 to 210.0
		JPt100	3	–199.9 to 500.0	–199.9 to 900.0
			4	0.0 to 100.0	0.0 to 210.0
	Thermocouple inputs	K	5	–200 to 1300	–300 to 2300
			6	–20.0 to 500.0	0.0 to 900.0
		J	7	–100 to 850	–100 to 1500
			8	–20.0 to 400.0	0.0 to 750.0
		T	9	–200 to 400	–300 to 700
			10	–199.9 to 400.0	–199.9 to 700.0
		E	11	0 to 600	0 to 1100
		L	12	–100 to 850	–100 to 1500
		U	13	–200 to 400	–300 to 700
			14	–199.9 to 400.0	–199.9 to 700.0
		N	15	–200 to 1300	–300 to 2300
		R	16	0 to 1700	0 to 3000
		S	17	0 to 1700	0 to 3000
		B	18	100 to 1800	300 to 3200
		W	19	0 to 2300	0 to 4100
		PLII	20	0 to 1300	0 to 2300
	ES1B Infrared Temperature Sensor	10 to 70°C	21	0 to 90	0 to 190
		60 to 120°C	22	0 to 120	0 to 240
		115 to 165°C	23	0 to 165	0 to 320
		140 to 260°C	24	0 to 260	0 to 500
Analog inputs	Current input	4 to 20 mA	25	Any one of the following ranges, by scaling: –1999 to 9999 –199.9 to 999.9 –19.99 to 99.99 –1.999 to 9.999	
		0 to 20 mA	26		
	Voltage input	1 to 5 V	27		
		0 to 5 V	28		
		0 to 10 V	29		
Temperature	Thermocouple	K	30 **V1.2**	–199.9 to 999.9	–199.9 to 999.9

4-1-2 Temperature Inputs

■ **Temperature Unit**

Either °C or °F can be selected.

Variable type	Parameter name	Setting range	Default
E0/A0	Temperature unit (Channel)	0: °C/1: °F	0

Conditions for use	The input type must be set to temperature input.

Note This parameter can be set only when operation is stopped.

■ **Cold Junction Compensation Method**

Specifies whether cold-junction compensation is performed in the Temperature Controller or externally.

Enable external cold-junction compensation when using two thermocouples to measure a temperature difference or using a external cold-junction compensator for even greater precision.

Variable type	Parameter name	Setting range	Default
E0/A0	Cold Junction Compensation Method (Common)	0: External / 1: Internal	1

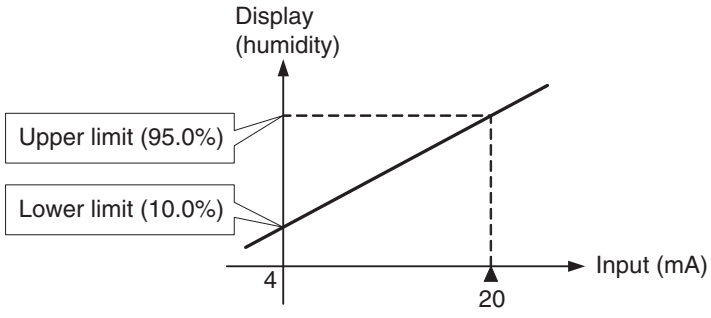
Conditions for use	The input type must be set to thermocouple or infrared temperature sensor.

Note This parameter can be set only when operation is stopped.

4-1-3 Analog Inputs

When an analog input is selected, scaling can be performed as needed by the control application.

- The Scaling Upper Limit, Scaling Lower Limit, and Decimal Point Position parameters are used for scaling. These parameters cannot be used when a temperature input type is selected.
- The Scaling Upper Limit parameter sets the physical quantity to be expressed by the upper limit value of input, and the Scaling Lower Limit parameter sets the physical quantity to be expressed by the lower-limit value of input. The Decimal Point Position parameter specifies the number of digits below the decimal point.
- The following example shows scaling of an analog input (4 to 20 mA). After scaling, the humidity can be read directly. In this case, the decimal point is set for 1 digit below the decimal point.



Variable type	Parameter name	Setting range	Default
E0/A0 (See note.)	Scaling Upper Limit (Channel)	−1999 to 9999	1000
	Scaling Lower Limit (Channel)	−1999 to 9999	0
	Decimal Point Position (Channel)	0: **** (no decimal point) 1: ***.* 2: **.** 3: *.***	1

Conditions for use	The input type must be set to analog input.

Note This parameter can be set only when operation is stopped.
Always set the Scaling Upper Limit > Scaling Lower Limit.
If the Scaling Lower Limit > Scaling Upper Limit, the larger value will function as the Scaling Upper Limit.

■ Setting Example

In this example, scaling is set to display 0 to 5 V as 10.0% to 95.0%.

Scaling Upper Limit = 950
Scaling Lower Limit = 100
Decimal Point Position = 1

4-1-4 Input Shift (Correction)

If there is a significant difference between the temperature at the measurement point and the location where the temperature display is needed so that the display/control performance is unsatisfactory at the present sensor position (measurement point), the temperature difference can be set as an input shift (correction) value.

Variable type	Parameter name	Setting range	Default
D5/95	Input Value 1 for Input Correction (Channel)	−199.9 to 999.9 EU (See note 1.)	0
	Input Shift 1 (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0
	Input Value 2 for Input Correction (Channel)	−1999 to 9999 EU (See note 1.)	1000
	Input Shift 2 (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0

Conditions for use	No special conditions

Note (1) The decimal point position is determined by the sensor selection.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

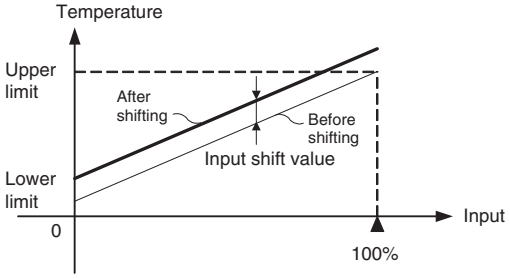
Simple Shift: One-point Shift

The temperature measurements at all points in the sensor range are shifted. For example, make the following settings if you want to increase the temperature by 1.2°C.

- Input Shift 1 = Input Shift 2 = 1.2

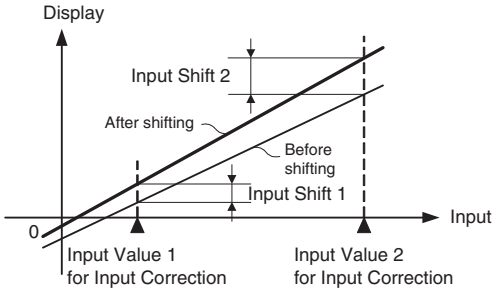
Note It is not necessary to set the Input Value 1 for Input Correction or Input Value 2 for Input Correction parameters. Leave these parameters set to their default settings.

When the measured value after the setting is 200°C, the process value will become 201.2°C



Advanced Shift: Two-point Shift

A linear compensation can be applied by setting the Input Value 1 for Input Correction in Input Shift 1 and independently setting the Input Value 2 for Input Correction in Input Shift 2. If different shift values are set for Input Shift 1 and Input Shift 2, the slope of the line may be different before and after applying the input shift.

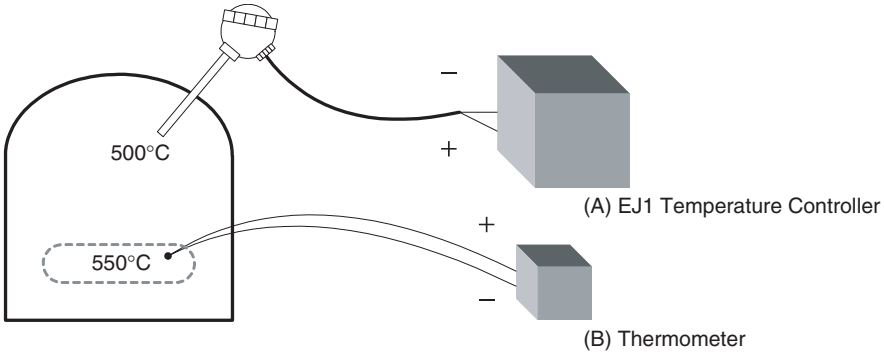


Calculating Input Shift Values

Measure the temperature at two points: the present value displayed by the EJ1 and the location (control target) that needs to be displayed.

Preparations

1. Set the input type to match the sensor being used.
2. Prepare a thermometer capable of measuring the temperature of the control target as shown in the following diagram so that a 2-point shift can be performed.



Two-point Shift Method

1,2,3...

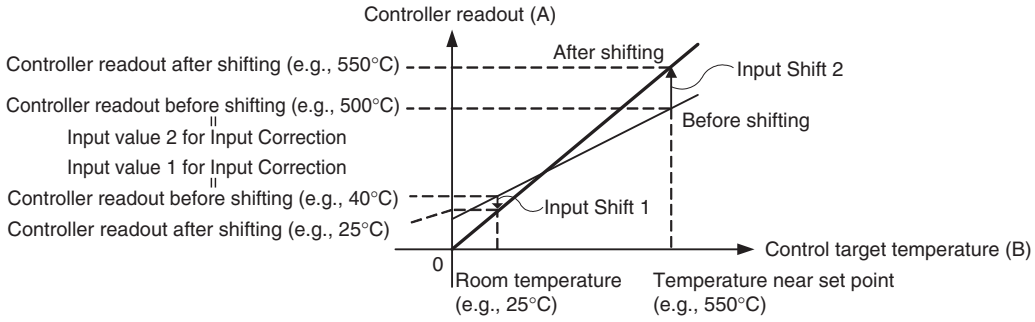
1. Shift the controller readout at two reference temperatures, near room temperature and near the value at which the temperature of the control target is to be controlled. Bring the temperature of the control target close to room temperature and close to the set point, and check control target temperature (B) and controller readout (A).
2. Check the temperature of the control target near room temperature (B) and the controller readout (A), and calculate the temperature difference as shown below.

Object temperature (B) − Controller readout (A)

   Set the temperature difference as Input Shift 1 and set the controller readout (A) as Input Value 1 for Input Correction.
3. Check the temperature of the control target near set-point temperature (B) and the controller readout (A), and calculate the temperature difference as shown below.

Object temperature (B) − Controller readout (A)

   Set the temperature difference as Input Shift 2 and set the controller readout (A) as Input Value 2 for Input Correction.
4. After you have set the calculated values, check controller readout (A) and control target temperature (B).
5. In this case, the two-point shift was performed near room temperature and the set-point temperature, but if you want to improve accuracy near the set point, perform the two-point shift at points above and below the set-point temperature. An example shift is shown in the following diagram.


Controller readout (A)
After shifting
Controller readout after shifting (e.g., 550°C)
Input Shift 2
Controller readout before shifting (e.g., 500°C)
Before shifting
Input value 2 for Input Correction
Input value 1 for Input Correction
Controller readout before shifting (e.g., 40°C)
Input Shift 1
Controller readout after shifting (e.g., 25°C)
Control target temperature (B)
0
Room temperature (e.g., 25°C)
Temperature near set point (e.g., 550°C)

■ **Two-point Shift Example**

In this example, the input type is set to K (5): −200°C to 1,300°C.
Check the temperature of the control target.

When room temperature (B) = 25°C,
the Controller readout (A) = 40°C.

When the temperature near the set point (B) = 550°C,
the Controller readout (A) = 500°C.

In this case, the input shift parameters are calculated as follows:

Input Value 1 for Input Correction = Controller readout (A) = 40°C

Input Shift 1 = Object temperature (B) - Controller readout (A) =
25°C − 40°C = −15.00°C

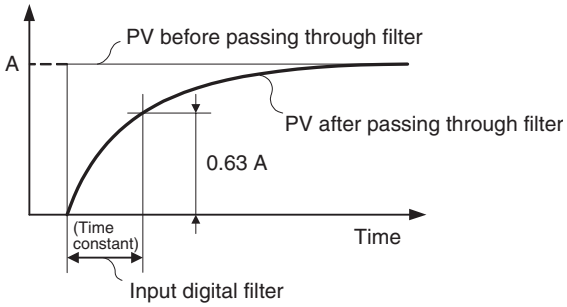
Input Value 2 for Input Correction = Controller readout (A) = 500°C

Input Shift 2 = Object temperature (B) - Controller readout (A) = 550°C − 500°C = 50.00°C

4-1-5 Input Filter

Sets the time constant of the digital input filter.

The following diagram shows the response of the digital filter to a step-wise input of amplitude A.



Variable type	Parameter name	Setting range	Default
D5/95	Input Digital Filter (Channel)	0.0 to 999.9 Seconds	0.0

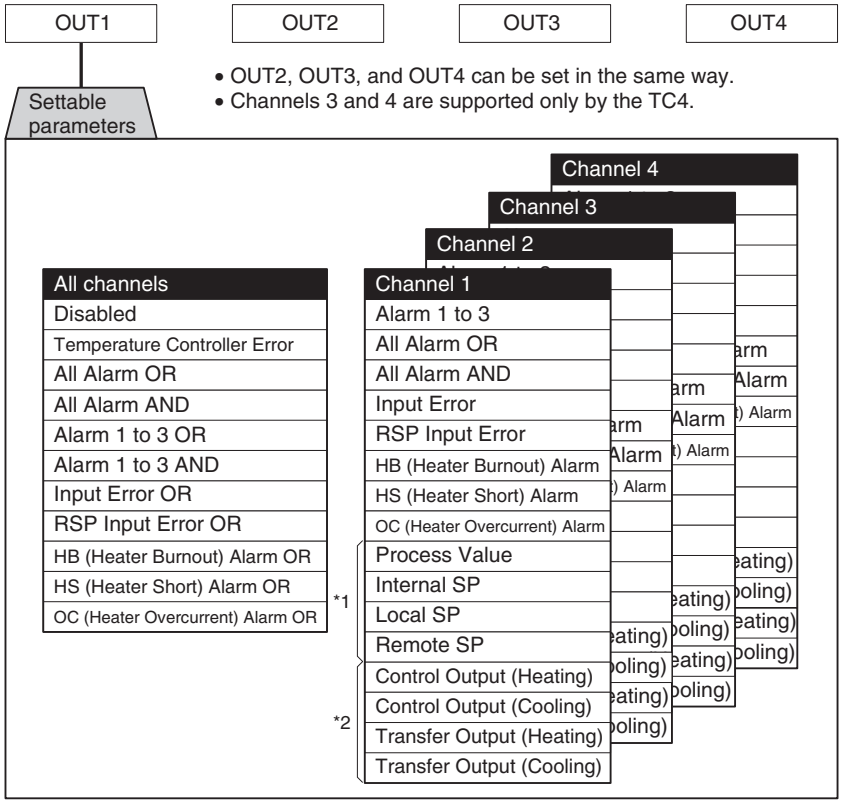
Conditions for use	No special conditions

4-2 Setting Output Specifications

4-2-1 Control Output Assignments

The parameters shown in the following diagram can be assigned to each output by setting the control output assignments.

The same parameter can be assigned to different outputs.



Note (1) Temperature Controller Error
The Temperature Controller Error output will turn ON when an bit between bit 0 and bit 13 in the Device A Status is ON. It can be used to output EJ1 error status. Refer to *Status Lists* on page 256 for details on Device A Status.

(2) If any parameters other than those marked with *1 and *2 are assigned to outputs for Controllers with linear outputs, 100% will be output for ON and 0% will be outputs for OFF. This will also apply to parameters marked with *2 if the control method is set to ON/OFF control.

Variable type	Parameter name	Setting range	Default	
			TC4	TC2
E1/A1	Control Output 1 Assignment (I/O)	0 to 144	47	
	Control Output 2 Assignment (I/O)	0 to 144	79	
	Control Output 3 Assignment (I/O)	0 to 144	111	32
	Control Output 4 Assignment (I/O)	0 to 144	143	64

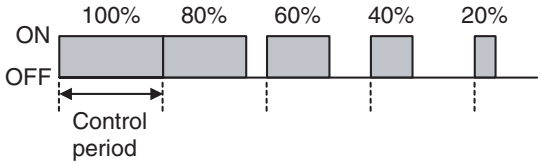
Conditions for use	No special conditions

Note These parameters can be set only when operation is stopped.
Refer to *Parameter List* on page 235 for details on the settings.

4-2-2 Control Output Method

The time-proportional output method is used for the control output.

The MV determines the percentage of time that the output is ON during each control period.



Note Control responsiveness improves as the control period is shortened, but if relays are being used for heater control, the relay lifetime will also be shortened so we recommend using a control period of at least 20 seconds.

Variable type	Parameter name	Setting range	Default
E1/A1	Control Period 1 to 4 (I/O)	0 to 99 s	2

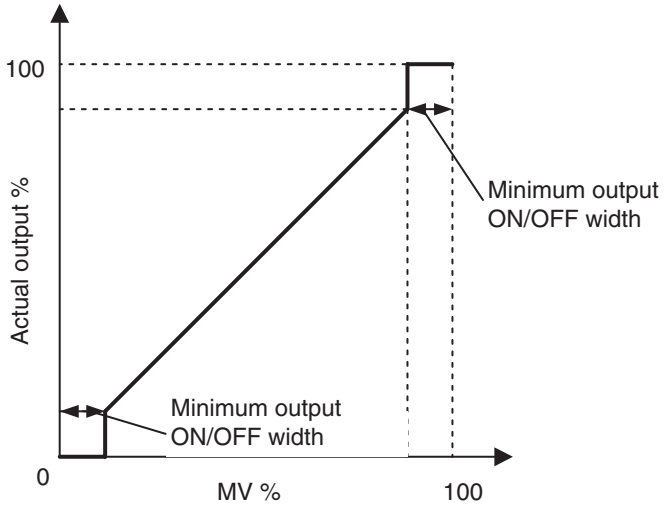
Conditions for use	Control output must be assigned and set to 2-PID control. These parameters are not valid for outputs 1 and 2 on Controllers with linear outputs.

Note This parameter can be set only when operation is stopped. If the parameter is set to 0, the period will be 0.5 s.

4-2-3 Minimum output ON/OFF width V1.2

Set the minimum output ON/OFF width.

When using output relays, this function can be used to prevent the relay from deteriorating. The relationship between MV and actual output is shown in the following diagram.



Example:

When the control period is 10 s, the minimum output ON/OFF width is 10.0%, and the MV is less than 10.0%, the output will be 0%. When the MV is 90.0% or greater, the output will be 100%.

Variable type	Parameter name	Setting range	Default
E1/A1	Minimum output ON/OFF width (IO)	0.0 to 50.0%	1.0

Conditions for use	Control output must be assigned and set to 2-PID control. These parameters are not valid for outputs 1 and 2 on Controllers with linear outputs.

Note

(1) This parameter can be set only when operation is stopped.

(2) When the control cycle is short due to the 2-ms output resolution, the Unit may not operate as set. For example, when the Control Cycle = 1 s and the Output Minimum ON/OFF Duration = 0.1%, the calculation becomes 1 s (1,000 ms) x 0.1% = 1 ms, but the actual output minimum ON/OFF duration is 2 ms.

⚠ **Caution** If the Output Minimum ON/OFF Duration is too large, control performance may suffer.

4-2-4 Output ON Scheduling Function

The ON time for each output can be reduced to one half or one fourth of the control period to limit the number of outputs in the Unit that are ON simultaneously.

Output ON Scheduling Method	Number of outputs ON simultaneously	Each output's limit (See note.)
No offset	4	100%
1/2	2	50%
1/4	1 (No others ON)	25%

Note When the MV is assigned to an output, the actual limit is either this value or the MV limit value, whichever is lower.

Variable type	Parameter name	Setting range	Default
F0/B0	Output ON Scheduling Method (Common)	0: No offset 1: 1/2 2: 1/4 (invalid for TC2)	0
	Delay between Outputs (Common)	0 to 1000 ms (See note 2.)	10

Conditions for use	Control output must be assigned and set to standard control, 2-PID control. A Controller with pulse outputs must be used.

Note

(1) When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

(2) Set the Delay between Outputs parameter to an even number. If an odd number is set, the next smaller even number will be used.

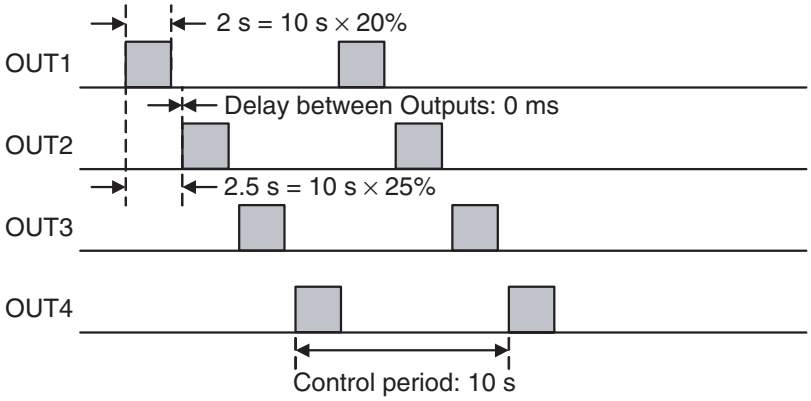
⚠ **Caution**

- Set the Output Mode Selection parameters to Standard Control for all of the Unit's channels. The Output ON Scheduling function will be disabled if the parameter is not set to Standard Control.

- Even if the Output ON Scheduling Method is set, the outputs may be ON at the same time due to the delay in the output device's operation. In this case, you can prevent the outputs from being ON simultaneously by setting a delay with the Delay between Outputs parameter. Refer to the following setting examples for details on using the delay.
- When using both this function and autotuning, always set this function before performing autotuning. If this function is set after autotuning, control performance may deteriorate.
- When using this function, set the following parameters to their default settings: Output Scaling Upper Limit 1 to 4, Output Scaling Lower Limit 1 to 4, and Decimal Point C1 to C4. If these parameters are not set to their defaults, the Output ON Scheduling function will not operate properly.
- This function will also be applied to manual outputs, outputs during errors, and outputs while stopped, so these outputs may be lower than their set values.
- When using the Output ON Scheduling function, all of the Unit's outputs will operate with the OUT1 control period.
- ST will be disabled when using the Output ON Scheduling Method. **V1.2**

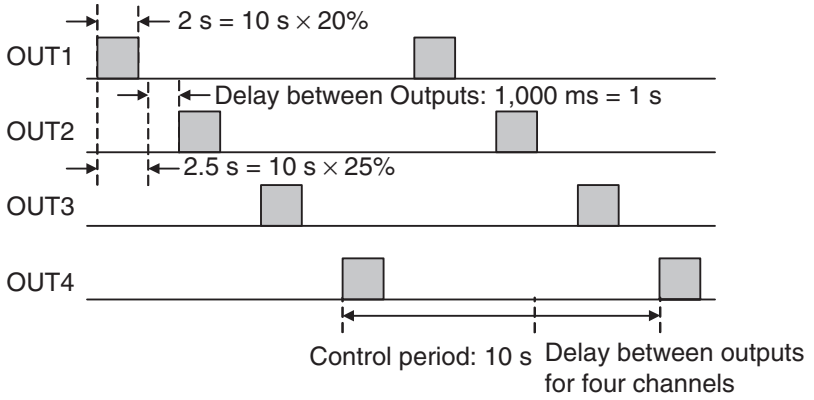
Example 1 Delay between Outputs = 0 ms

Unit	TC4
Control period	10 s
Output ON Scheduling Method	1/4 (Limit to 25% of the maximum MV.)
Delay between Outputs	0 ms
MV for all channels	20%



Example 2 Delay between Outputs = 1 s

Unit	TC4
Control period	10 s
Output ON Scheduling Method	1/4 (Limit to 25% of the maximum MV.)
Delay between Outputs	1,000 ms = 1 s
MV for all channels	20%


2 s = 10 s × 20%
OUT1
Delay between Outputs: 1,000 ms = 1 s
OUT2
2.5 s = 10 s × 25%
OUT3
OUT4
Control period: 10 s
Delay between outputs for four channels

Note The Delay between Outputs parameter can be set to offset the ON time for each output. The delay between outputs will, however, create an OFF period between outputs, making it appear that the control period has increased. The actual power is 2/(10 + 4) × 100 = 14.3%.

4-2-5 Output Scaling

A slope (gradient) and offset can be set for each value selected with the control output assignment.

The value selected with the control output assignment will be 100% when it equals the Output Scaling Upper Limit and the value will be 0% when it equals the Output Scaling Lower Limit.

The decimal point positions for the Output Scaling Upper and Lower Limits are set with the Decimal Point C1 to C4 parameters. Change the decimal point position setting if necessary.

Variable type	Parameter name	Setting range	Default
E1/A1	Output Scaling Upper Limit 1 to 4 (I/O)	–1999 to 9999	100
	Output Scaling Lower Limit 1 to 4 (IO)	–1999 to 9999	0
	Decimal Point C1 to C4 (IO)	0: **** (no decimal point) 1: ***.* 2: **.** 3: *.***	0

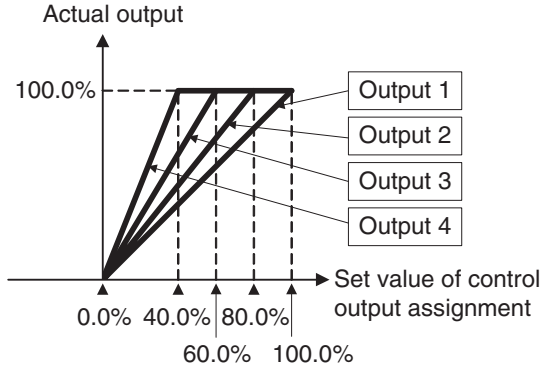
Conditions for use	The Control Method must be set to *2-PID Control* and the Control Output Assignment must be set to *Control output (heating)* or *Control output (cooling)*.

Note

(1) These parameters can be set only when operation is stopped.

(2) Use 40% AT when output scaling has been set. If 100% AT is used, hunting will occur.

Example: Making All TC4 Outputs into CH1 Control Output (Heating) with Different Slopes



Output	Parameter name	Set value
Output 1	Control output 1 assignment	CH1 Control output (heating)
	Output Scaling Upper Limit 1	100
	Output Scaling Lower Limit 1	0
		0
Output 2	Control output 2 assignment	CH1 Control output (heating)
	Output Scaling Upper Limit 2	80
	Output Scaling Lower Limit 2	0
	Decimal Point C2	0
Output 3	Control output 3 assignment	CH1 Control output (heating)
	Output Scaling Upper Limit 3	60
	Output Scaling Lower Limit 3	0
	Decimal Point C3	0
Output 4	Control output 4 assignment	CH1 Control output (heating)
	Output Scaling Upper Limit 4	40
	Output Scaling Lower Limit 4	0
	Decimal Point C4	0

4-2-6 Transfer Outputs

Output 1 and output 2 on Controllers with linear outputs can be used as transfer outputs. Use the following procedure.

1,2,3... 1. Set the parameter to be output on the transfer output.

The parameter to be output is set using the Control Output Assignment parameter. Select one of the following values. Refer to *4-2-1 Control Output Assignments* for details on the assigning the control output.

Process Value, Internal SP, Local SP, Remote SP, Transfer Output (Heating), Transfer Output (Cooling)

2. Set the type of linear output. Use the following parameter.

Variable type	Parameter name	Setting range	Default
E1/A1	Linear Output 1/2 Type (I/O)	0: 4-20 mA 1: 0-20 mA	0

Conditions for use	A Controller with linear outputs must be used.

3. Set the output range for the transfer output.

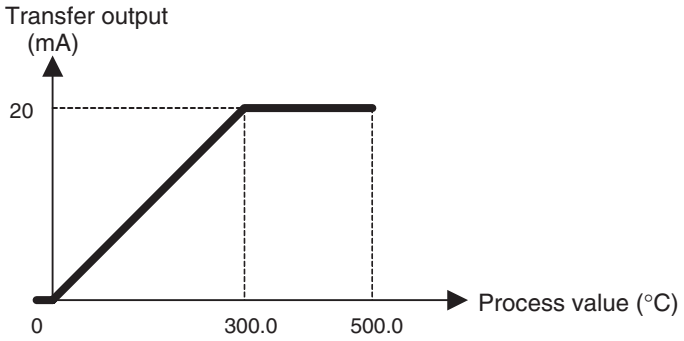
The range set for output scaling is used as the output range for the transfer output. Refer to *4-2-5 Output Scaling* for information on output scaling.

■ **Example:**

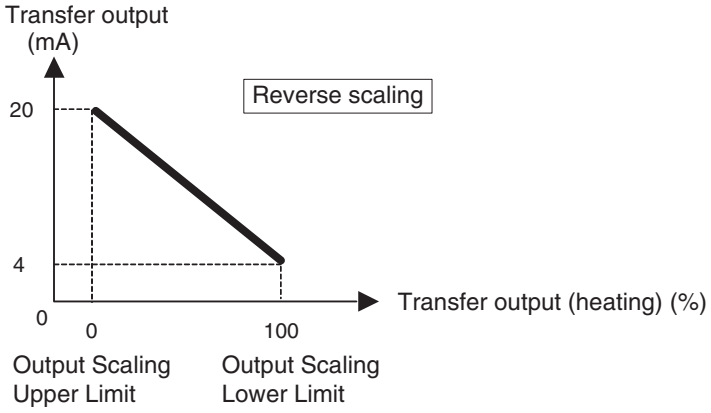
The following example outputs the process value on a transfer output.

Parameter	Default
Input Type	6 (–20.0 to 500.0°C)
Control Output 1 Assignment	43 (channel 1 process value)
Linear Output 1 Type	1 (0 to 20 mA)

Parameter	Default
Output Scaling Upper Limit 1	300
Output Scaling Lower Limit 1	0
Decimal Point C1	0



Reverse scaling can also be performed with output scaling.



4-3 Setting Control Specifications

4-3-1 Starting and Stopping Control

■ **Start Control (RUN) and Stop Control (STOP)**

The following two methods can be used to start/stop control. For details, refer to the corresponding pages.

(1) Starting/stopping control with an operation command: *6-4-11 Operation Commands*

(2) Starting/stopping control with an event input: *4-7-2 Event Inputs (TC2)*

■ **Operation After Power ON**

The operation after power goes ON can be set to Continue, Stop, or Manual mode operation. This setting also applies to operation after a software reset.

Variable type	Parameter name	Setting range	Default
F0/B0	Operation After Power ON (Common)	0: Continue 1: Stop 2: Manual Mode	0

Conditions for use	No special conditions

Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

Operation After Power ON		Operation	
		2-PID control	ON/OFF control
Continue	RUN/STOP	Retains the status that existed before power went OFF.	Same as 2-PID control
	Auto/Manual	Retains the status that existed before power went OFF.	Auto
	Manipulated variable	• For Auto mode before power OFF: MV depends on RUN/STOP status. When set to RUN, operation starts from the initial value. When set to STOP, operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.	0.0% or 100.0%
Stop	RUN/STOP	Stop	Same as 2-PID control
	Auto/Manual	Retains the status that existed before power went OFF.	Auto
	Manipulated variable	• For Auto mode before power OFF: Operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.	0.0%
Manual mode	RUN/STOP	Retains the status that existed before power went OFF.	---
	Auto/Manual	Manual	---
	Manipulated variable	• For Auto mode before power OFF: Operation starts from the MV at Stop parameter setting. • For Manual mode before power OFF: The manipulated variable from before power was interrupted is maintained.	---

4-3-2 Selecting the Control Method

The control method can be set to either 2-PID control or ON/OFF control.

Variable type	Parameter name	Setting range	Default
E5/A5	PID/OnOff (Channel)	0: 2-PID control 1: ON/OFF control	0

Conditions for use	No special conditions

Note This parameter can be set only when operation is stopped.

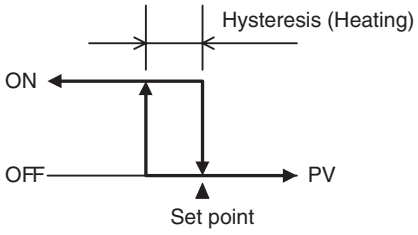
ON/OFF Control

In ON/OFF control, the control output turns OFF when the currently controlled temperature reaches a preset set point. When the manipulated variable turns OFF, the temperature begins to fall and the control output is turned ON again. This operation is repeated at a certain level. The Hysteresis (Heating) parameter determines how much the temperature must fall before the control output is turned ON again. Also, the Direct/Reverse Operation parameter determines whether the manipulated variable is increased or decreased in response to an increase or decrease in the process value.

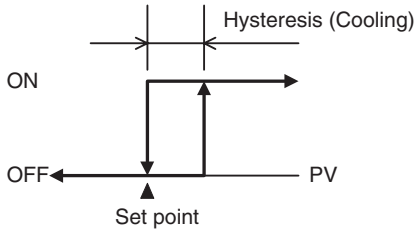
■ Hysteresis

ON/OFF control incorporates a hysteresis setting to stabilize operation when switching ON and OFF. The width of the hysteresis loop determines the sensitivity.

- The control output (heating) and control output (cooling) hysteresis settings are made with the Hysteresis (Heating) and Hysteresis (Cooling) parameters, respectively.
- The sensitivity of standard control (heating or cooling) is set with the Hysteresis (Heating) parameter, regardless of the setting of the Direct/Reverse Operation parameter.
- The Hysteresis (Cooling) parameter is effective only when using heating/cooling control.



Heating control



Cooling control

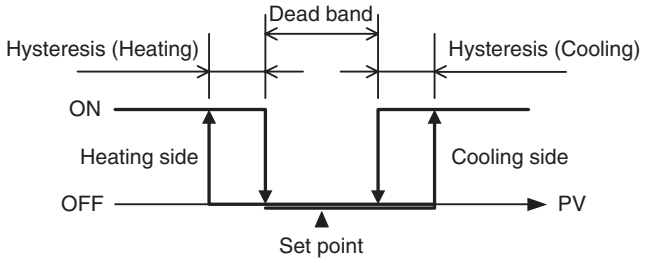
Variable type	Parameter name		Setting range	Default
D5/95	Hysteresis (Heating)	(Channel)	0.1 to 999.9 EU	1.0
	Hysteresis (Cooling)	(Channel)	0.1 to 999.9 EU	1.0

Conditions for use	The control method must be set to ON/OFF control.

Note The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

■ **Three-position Control**

In heating/cooling control, a dead band area can be set where the MV is 0% for both heating and cooling. with a dead band, 3-position control can be achieved.



2-PID Control (Two-degrees-of-freedom PID)

The proportional band (P), integral time (I), and derivative time (D) must be set for 2-PID control.

■ **PID Settings**

When the control characteristics are unknown, perform autotuning (AT) or self-tuning (ST with **V1.2**). When AT (or ST with **V1.2**) is executed, the optimum PID constants for the set point at that time are set automatically.

When the control characteristics are already known, the PID parameters can be set directly to adjust control. The PID parameters are set with the Proportional Band (P), Integral Time (I), and Derivative Time (D) parameters.

Note Refer to *4-3-8 Tuning* for details on autotuning or self-tuning (ST with **V1.2**).

Variable type	Parameter name		Setting range	Default
D0/90	Proportional Band	(BANK)	0.1 to 999.9 EU (See note 1.)	8.0
	Integral Time	(BANK)	0 to 3999 Seconds	233
	Derivative Time	(BANK)	0.0 to 999.9 Seconds	40.0

Conditions for use	The control method must be set to 2-PID control.

Note

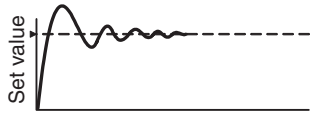
(1) Refer to *4-7-1 Bank Function* for details on banks.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

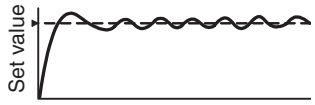
- Proportional action: In proportional action, the MV is proportional to the deviation (control error).
- Integral action: This control action produces an output that is proportional to the time integral of the control error. An offset normally occurs in proportional control, so proportional action is used in combination with integral action. As time passes, this offset disappears and the control temperature (process value) matches the set point.

- Derivative action: This control action produces an output that is proportional to the rate of change of the input. Since proportional control and integral control correct for errors in the control result, the control system will be slow to respond to sudden changes in temperature. The derivative action performs a corrective action by increasing the MV in proportion to the slope of the temperature change.

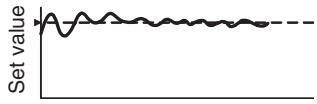
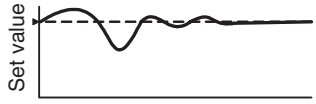
- Effect of Changes to P (Proportional Band)

Increased P		The curve rises gradually and the settling time is long, but overshooting is prevented.
Decreased P		Overshooting and hunting occur, but the set value is reached quickly and the temperature stabilizes.

- Effect of Changes to I (Integral Time)

Increased I		It takes a long time for the process value to reach the set point. It takes time to achieve a stable state, but overshooting, undershooting, and hunting are reduced.
Decreased I		Overshooting and undershooting occur. Hunting occurs. The process value rises quickly.

- Effect of Changes to D (Derivative Time)

Increased D		Overshooting, undershooting, and the settling time are reduced, but fine hunting occurs on the changes themselves.
Decreased D		Overshooting and undershooting are increased and it takes time for the process value to reach the set point.

■ **Proportional Band x 10 Compensation**

When this parameter is set to *Enabled*, the proportional band is increased by a factor of 10. Use this parameter when the proportional band setting range is insufficient.

Variable type	Parameter name	Setting range	Default
F0/B0	Proportional Band × 10 Compensation (Common)	0: Disabled 1: Enabled	0

Conditions for use	The control method must be set to 2-PID control.

Note When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

■ **Setting the Alpha**

This parameter sets the 2-PID constant alpha (α).

Note Normally, this parameter is left at its default value.

Variable type	Parameter name	Setting range	Default
D5/95	Alpha (Channel)	0.00 to 1.00	0.65

Conditions for use	The control method must be set to 2-PID control.

4-3-3 Selecting the Output Mode

Either standard control or heating/cooling control can be selected as the output method.

Variable type	Parameter name	Setting range	Default
E5/A5	Output Mode Selection (Channel)	0: Standard control 1: Heating/cooling control	0

Conditions for use	No special conditions

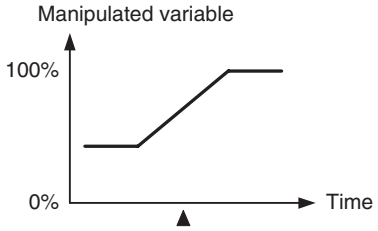
Note This parameter can be set only when operation is stopped.

Standard Control

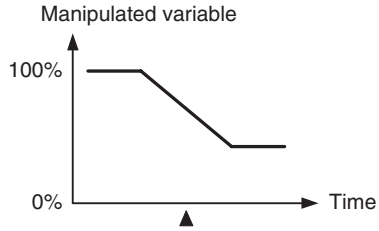
This mode performs standard heating or cooling control. Set the Direct/Reverse Operation parameter to reverse operation for heating control or direct operation for cooling control.

■ **Direct Operation (Cooling) and Reverse Operation (Heating)**

Direct operation (cooling) refers to control where the manipulated variable is increased in response to an increase in the process value. Alternatively, reverse operation (heating) refers to control where the manipulated variable is decreased in response to an increase in the process value.



Direct operation



Reverse operation

For example, when the process value (PV) is lower than the set point (SP) in a heating control system, the manipulated variable increases according to the difference between the PV and SP. Accordingly, this is “reverse operation” in a heating control system and “direct operation” in a cooling control system, which performs the opposite operation.

Variable type	Parameter name	Setting range	Default
E5/A5	Direct/Reverse Operation (Channel)	0: Reverse operation 1: Direct operation	0

Conditions for use	No special conditions

Note This parameter can be set only when operation is stopped.

Heating/Cooling Control

To perform heating/cooling control, assign the control output (cooling) function to one of the outputs. For example, when you want to perform heating/cooling control with channel 1, assign channel 1 control output (cooling) to one of the outputs.

- Refer to *4-2-1 Control Output Assignments* for details on assigning the control output for cooling.
- The Cooling Coefficient and Dead Band parameters must be set for this PID control, in addition to the Proportional Band (P), Integral Time (I), and Derivative Time (D) parameters.

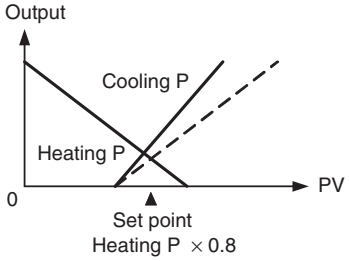
■ Cooling Coefficient

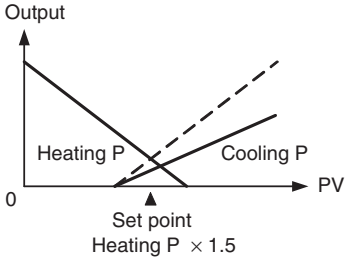
If the heating characteristics and cooling characteristics of the control object are very different and good control characteristics cannot be achieved with the same PID constants, the cooling coefficient can be used to adjust the proportional band (P) for the control output assigned to cooling. Use this to achieve balanced control between the heating side and cooling side.

The proportional bands (P) for the control outputs assigned to the heating/cooling sides can be calculated using the following equations.

- P for the heating side = P
- P for the cooling side = P for the heating side × Cooling coefficient

The cooling P is obtained by multiplying the heating P by the cooling coefficient, so the cooling output control characteristics are different from the heating output control characteristics.





Variable type	Parameter name	Setting range	Default
D0/90	Cooling Coefficient (BANK)	0.01 to 99.99	1.00

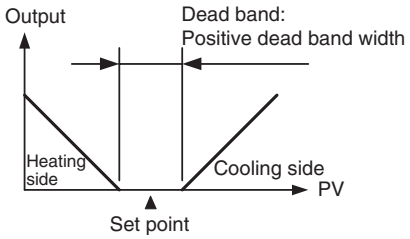
Conditions for use	The control method must be set to heating/cooling control and 2-PID control, and the independent heating/cooling PID method must be disabled.

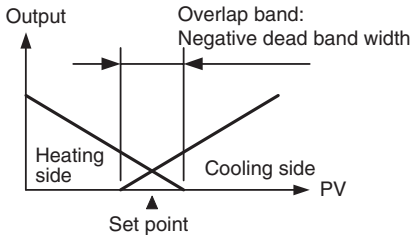
Note Refer to *4-7-1 Bank Function* for details on banks.

■ Dead Band

The dead band is set with the set point as its center.

Setting a negative value produces an overlap band.





Variable type	Parameter name	Setting range	Default
D0/90	Dead Band (BANK)	–199.9 to 999.9 EU	0.0

Conditions for use	The control method must be set to heating/cooling control.

Note The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).
Refer to *4-7-1 Bank Function* for details on banks.

■ **Manual Reset Value**

This parameter sets the required manipulated variable to remove the offset during settling in P or PD control.

Variable type	Parameter name	Setting range	Default
D0/90	Manual Reset Value (BANK)	0.0 to 100.0 %	50

Conditions for use	The control method must be set to standard control and 2-PID control and the integral time must be set to 0.

Note Refer to *4-7-1 Bank Function* for details on banks.

Independent heating/cooling PID method V1.2

When using the independent heating/cooling PID method, the heating and cooling PID can each be set individually. Air cooling, water cooling, and linear control methods can be selected depending on the control characteristics of the cooling side. Also, autotuning (AT) will automatically set the PID constants on the cooling side.

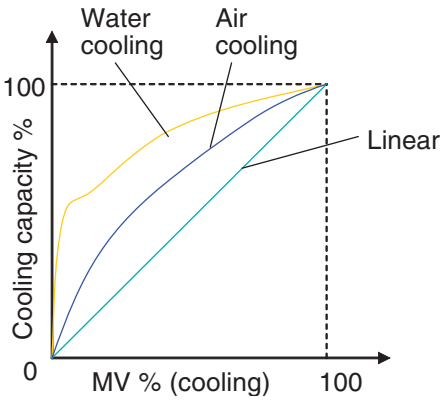
Note For more information on autotuning, refer to *4-3-8 Tuning*.

Variable type	Parameter name	Setting range	Default
E5/A5	Independent heating/cooling PID method (Channel)	0: Disabled 1. Air cooling 2. Water cooling 3: Linear	0
D0/90	Proportional Band (Cooling) (BANK)	0.1 to 999.9 EU (See note 2.)	8.0
	Integral Time (Cooling) (BANK)	0 to 3999 Seconds	233
	Derivative Time (Cooling) (BANK)	0.0 to 999.9 Seconds	40.0

Conditions for use	The control method must be set to heating/cooling control and 2-PID control.

Note
(1) Refer to *4-7-1 Bank Function* for details on banks.
(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

Air cooling/water cooling	Provides control for applications that have non-linear cooling characteristics (e.g., plastic molding machines). Provides good adaptability and stable response.
Linear	Provides control for applications that have linear cooling characteristics.



Note When using a relay for cooling output, the minimum output ON/OFF width can be used to prevent relay degradation. For details on this setting, refer to page 58.

4-3-4 Setting the Set Point

These parameters set the set point.

Variable type	Parameter name	Setting range	Default
D0/90	Set point (BANK)	–1999 to 9999 EU	0

Note The decimal point position is determined by the sensor selection.
Refer to *4-7-1 Bank Function* for details on banks.
Set the set point so that it is within the input range as well as the set point limiter range.
If the set point is out-of-range, the internal set point actually used for control will be limited to a value within the input range and set point limiter range.

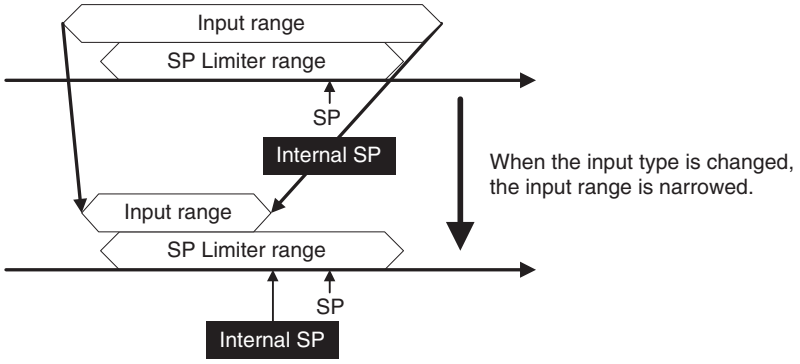
■ Set Point Limiter

These parameters apply a limit to the set point's setting range so that the control subject does not reach an abnormal temperature.

Variable type	Parameter name	Setting range	Default
D5/95	SP Upper Limit (Channel)	–1999 to 9999 EU	9999
	SP Lower Limit (Channel)	–1999 to 9999 EU	–1999

Conditions for use	No special conditions

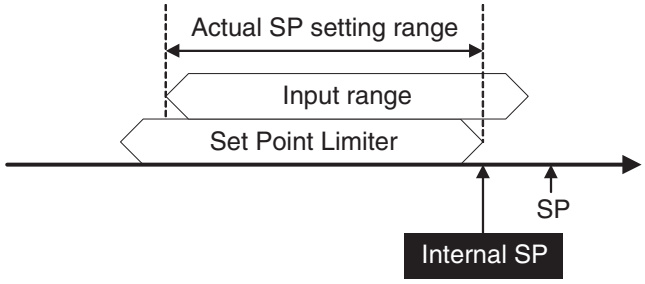
Note The decimal point position is determined by the sensor selection.
Set the SP Upper and Lower Limits within the input range and also set the SP Upper Limit > SP Lower Limit.
If the SP Lower Limit > SP Upper Limit, the larger value will function as the SP Upper Limit. In addition, if the limit range is set outside of the input range, it will be limited to the input range.
The SP will not be changed automatically, even if the input type or SP Limiter is changed. Although the SP will not be changed automatically, the internal SP used for control will be limited to the input range or SP Limiter (whichever range is narrower).



Note The SP is not changed, but the internal SP used for control is limited by the upper limit of the input range.

■ **SP Setting Example**

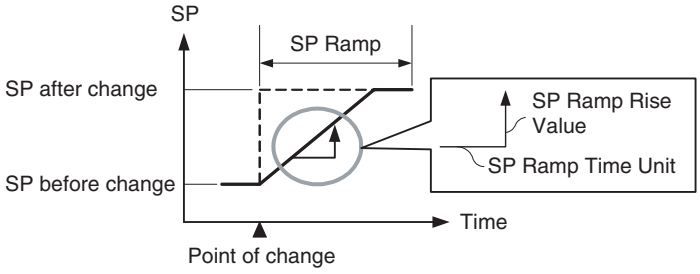
The internal SP, which is actually used for control, is limited by the input range and SP Limiter range.



4-3-5 Setting the SP Ramp

The SP ramp function restricts the width of changes in the set point as a rate of change. When the SP ramp function is enabled and the change width exceeds the specified rate of change, this function can restrict the set point within an area, as shown in the following diagram.

While the SP ramp function is operating, control will be performed not for the specified set point but rather for the set point restricted by the rate of change set for the SP ramp function.



The rate of change during SP ramp operation is specified by the SP Ramp Rise Value, SP Ramp Fall Value, and SP Ramp Time Unit parameters. The SP ramp function will operate when the SP Ramp Rise Value or SP Ramp Fall Value is not set to 0 (disabled).

The Ramp SP can be checked by using the Internal SP parameter.

Variable type	Parameter name	Setting/monitoring range	Default
E5/A5 (See note 1.)	SP Ramp Time Unit (Channel)	0: Seconds 1: Minutes	1
D0/90	SP Ramp Rise Value (BANK)	0 to 9999 EU/s or min (See note 2.)	0
	SP Ramp Fall Value (BANK)	0 to 9999 EU/s or min (See note 2.)	0
C4/84	Internal SP (Channel)	–1999 to 9999 EU	---

Conditions for use	ST must be disabled. V1.2

Note

(1) This parameter can be set only when operation is stopped.

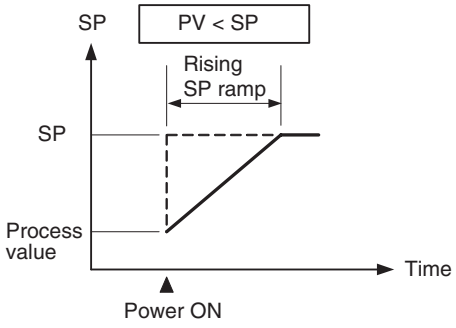
(2) The function is stopped if this parameter is set to 0. The unit is determined by the setting of the SP Ramp Time Unit parameter.
The decimal point position is determined by the sensor selection.
Refer to *4-7-1 Bank Function* for details on banks.

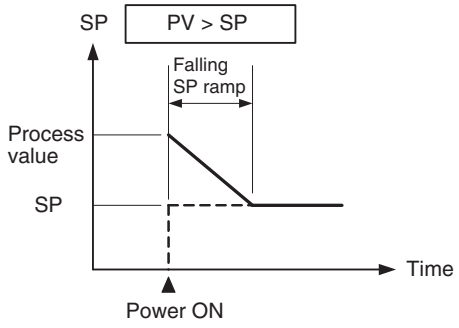
Note Refer to *4-4-8 Alarm SP Selection* for details on alarms during SP ramp operation.

Operation at Startup

If the SP ramp function is enabled when the Controller is turned ON or switched from STOP to RUN mode, the process value may reach the set point using the SP ramp function in the same way as when changing the set point.

SP ramp operation at startup depends on the relationship between the process value and the set point, as shown in the following diagrams.



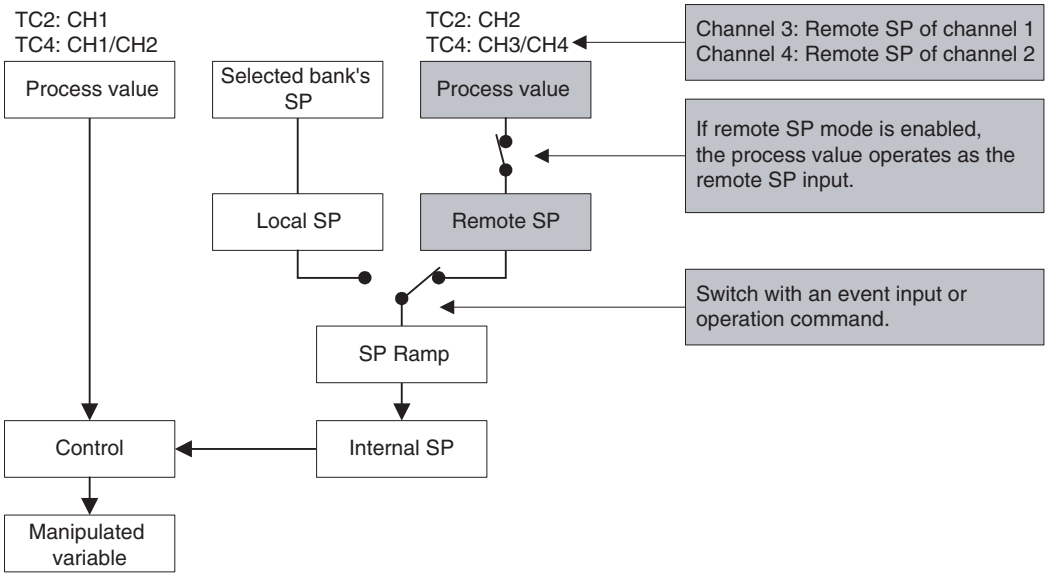


Restrictions during SP Ramp Operation

- Autotuning is started after the SP ramp operation has been completed.
- The SP ramp operation will continue even if operation is switched to manual mode.
- When control is stopped or an error occurs, the SP ramp function will be disabled.
- When starting SP ramp operation, always switch from STOP to RUN mode in Auto Mode.

4-3-6 Remote SP

The remote SP function uses another channel's input as the set point for control. To operate the function, set the Remote SP Enable parameter to Enable and select the remote SP with an event input or operation command.



Local SP	Sets the selected bank's set point.
Remote SP	Sets the process value of the channel specified as the remote SP input.
Internal SP	This is the set point actually set for use in control.

Variable type	Parameter name	Setting/monitoring range	Default
F0/B0 (See note 1.)	Remote SP Enable (Common)	0: Disabled 1: Enabled	0
C4/84	Local SP Monitor (Channel)	−1999 to 9999 EU (See note 3.)	---
	Remote SP Monitor (See note 2.) (Channel)	−1999 to 9999 EU (See note 3.)	---

Conditions for use	No special conditions

Note

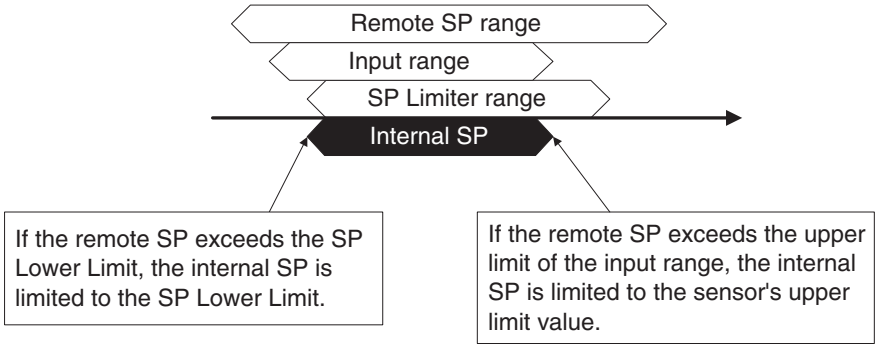
(1) When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

(2) The remote SP function can be used for channel 1 or channel 2 for the TC4, but only for channel 1 for the TC2.

(3) The decimal point position is determined by the sensor selection.

⚠ Caution

- When remote SP is enabled, ST will be disabled. **V1.2**
- If autotuning starts during remote SP operation, autotuning will be executed with the SP that existed when autotuning started. After autotuning is completed, control will start based on the remote SP value.
- The remote SP cannot be used as a reset condition for a standby sequence.
- Effective Range of the Remote SP
  The following diagram shows the internal SP that will actually be used in control if the remote SP's range is wider than the input range or SP limiter range.


Remote SP range
Input range
SP Limiter range
Internal SP
If the remote SP exceeds the SP Lower Limit, the internal SP is limited to the SP Lower Limit.
If the remote SP exceeds the upper limit of the input range, the internal SP is limited to the sensor's upper limit value.

Note The remote SP's range will not be changed automatically, even if the input type or SP Limiter is changed.

Switching between the Remote SP and Local SP

Use an event input or operation command to switch between the remote SP and local SP. When using an event input for switching, set the Event Input Assignment to *Local SP* (0)/*Remote SP* (1). After making the event input setting, the SP will operate as shown in the following table.

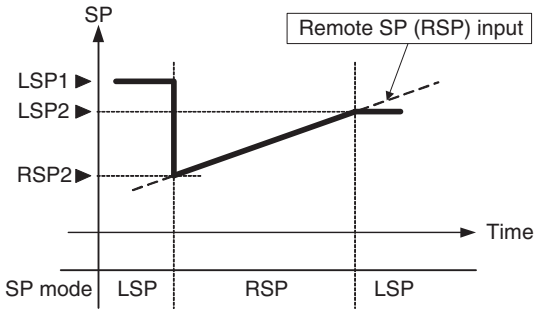
Event input	Operation
OFF	Selects the local SP.
ON	Selects the remote SP.

Note Refer to *6-4-11 Operation Commands* for details on using an operation command to switch the SP.

■ SP Tracking

If SP Tracking is enabled, the local SP inherits the remote SP value when the SP is switched from the remote SP to the local SP.

The following diagram shows how the SP mode is switched when SP Tracking is enabled.



1,2,3...

1. When the SP is at LSP1 and operation is switched to the remote SP, the SP switches to RSP2.
2. The SP progresses according to the remote SP input.
3. If the SP Tracking function is enabled when control is switched to the local SP, the SP will become LSP2. If SP Tracking is disabled, the SP will remain LSP1.
   - If the SP Ramp function was enabled when operation switched from the local SP to the remote SP, the SP ramp function will operate.

Variable type	Parameter name	Setting range	Default
E5/A5 (See note.)	SP Tracking (Channel)	0: Disabled 1: Enabled	0

Conditions for use	The Remote SP function must be enabled.

Note This parameter can be set only when operation is stopped.
SP tracking can be used for channel 1 or channel 2 for the TC4, but only for channel 1 for the TC2.

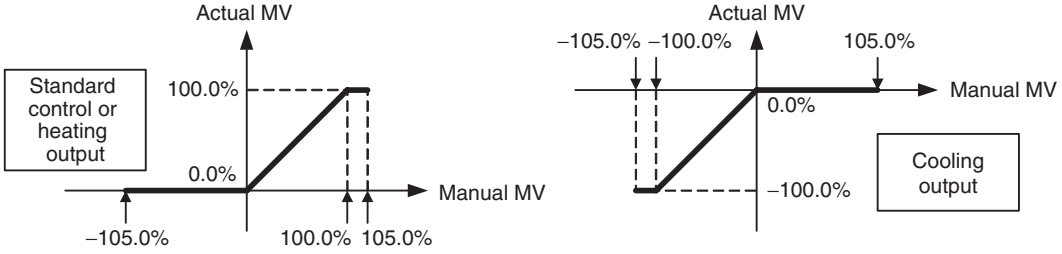
4-3-7 Setting the Manipulated Variable (MV)

■ **Manual MV**

If control is set to manual mode, the standard control function will stop and the MV set in the Manual MV parameter can be output.

Variable type	Parameter name	Setting range	Default
D5/95	Manual MV (Channel)	–5.0 to 105.0 (for standard control) % –105.0 to 105.0 (for heating/cooling control) %	0

Conditions for use	The control method must be set to 2-PID control in manual mode.



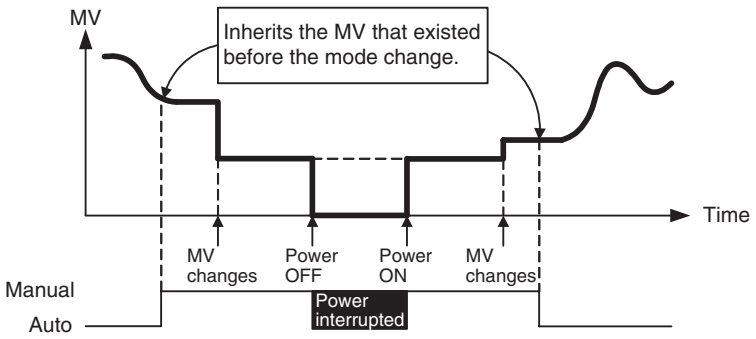
Use an event input or operation command to switch between auto mode (standard control) and manual mode. When using an event input to switch modes, set the Event Input Assignment parameter to Auto (0)/Manual (1). After the event input is set, it will operate as follows:

Event input	Operation
OFF	Auto Mode
ON	Manual Mode

Note Refer to *6-4-11 Operation Commands* for details on using an operation command to switch the mode.
Check the Channel Status parameter (variable type C4/84) to confirm whether the Controller is in auto mode or manual mode.

Operation When Switching between Auto and Manual Modes

The following diagram shows the operation when the mode is switched between auto mode and manual mode.



■ **MV at Stop**

This parameter sets the MV when control is stopped.
For heating/cooling control, the MV at Stop parameter applies to the cooling side if the MV is negative and to the heating side if the MV is positive.
The default is 0.0, so an MV will not be output for either standard or heating/cooling control with the default setting.

Variable type	Parameter name	Setting range	Default
D5/95	MV at Stop (Channel)	–5.0 to 105.0 (for standard control) % –105.0 to 105.0 (for heating/cooling control) %	0

Conditions for use	The control method must be set to 2-PID control.

The order of priority is as follows: **Manual MV > MV at Stop > MV at PV Error.**

■ **MV at PV Error**

This parameter sets the MV when an input error or remote SP input error occurs.

Variable type	Parameter name	Setting range	Default
D5/95	MV at PV Error (Channel)	–5.0 to 105.0 (for standard control) % –105.0 to 105.0 (for heating/cooling control) %	0

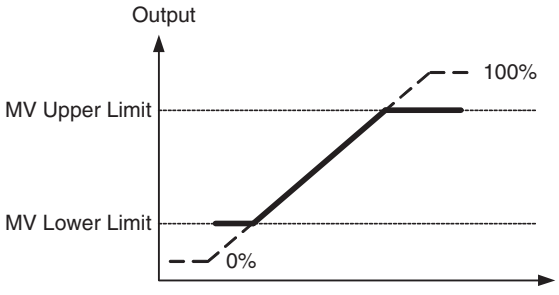
Conditions for use	The control method must be set to 2-PID control.

The order of priority is as follows: **Manual MV > MV at Stop > MV at PV Error**.

■ **MV Limiter**

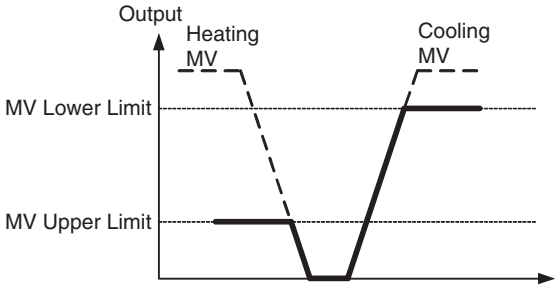
This function limits the MV output by applying upper and lower limits to the calculated MV.

- The following MVs take priority over the MV limits.
  - Manual MV
  - MV at Stop
  - MV at PV Error



Output Mode Selection = Standard control

- For heating/cooling control, upper and lower limits are set on overall heating/cooling control.
  (They cannot be set separately for heating and cooling.)



Output Mode Selection = Heating/cooling control

Variable type	Parameter name	Setting range	Default
D5/95	MV Upper Limit (Channel)	–5.0 to 105.0 (for standard control) 0.0 to 105.0 (for heating/cooling control) %	105.0
	MV Lower Limit (Channel)	–5.0 to 105.0 (for standard control) –105.0 to 0.0 (for heating/cooling control) %	–105.0

Conditions for use	The control method must be set to 2-PID control, and ST must be disabled. **V1.2**

Note Set the limits so that the MV Upper Limit > MV Lower Limit.
If the MV Lower Limit > MV Upper Limit, the larger value will function as the MV Upper Limit.

4-3-8 Tuning

Autotuning (AT)

When autotuning (AT) is executed, the MV is forcibly changed, the control subject's characteristics are observed (with the limit cycle method), and the best PID constants are automatically set for the SP during execution.

- Autotuning cannot be executed while control is stopped, during manual mode operation, or during ON/OFF control.
- Use an operation command to execute autotuning. For details, refer to *6-4-11 Operation Commands*.
- The only parameters that can be received during autotuning are RUN/STOP, Auto/Manual, AT Execute/Cancel, Alarm 1/2/3 Latch Cancel, and Alarm Latch Cancel All. Other parameters cannot be changed.
- If the STOP parameter is set during autotuning, autotuning will be cancelled and operation will stop. Autotuning will not be restarted even if RUN is set again.
- Executing 40% AT is not possible for heating/cooling control.
- When using the independent cooling/heating PID method, the PID constant will be set automatically for the heating and cooling side. **V1.2**
- Normally the following parameters are left at their default settings.

Variable type	Parameter name		Setting range	Default
E5/A5	AT Calculated Gain	(Common)	0.1 to 10.0	0.8
	AT Hysteresis	(Channel)	0.1 to 999.9 EU (See note 2.)	0.8
	Limit Cycle MV Amplitude	(Common)	5.0 to 50.0 %	20.0
	Temporary AT Execution Judgment Deviation	(Channel)	0.0 to 999.9 EU (See note 2.)	150.0

Conditions for use	The control method must be set to 2-PID control.

Note (1) This parameter can be set only when operation is stopped.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

■ **AT Calculated Gain**

Sets the gain used when calculating the PID constants in autotuning. When emphasizing flexibility, decrease set value. When emphasizing stability, increase the set value.

■ **AT Hysteresis**

The limit cycle operation during autotuning has a hysteresis when switching ON and OFF. This parameter sets that hysteresis value.

■ **Limit Cycle MV Amplitude**

Sets the MV amplitude during limit cycle operation in autotuning.

Note This parameter is disabled for 100% AT.

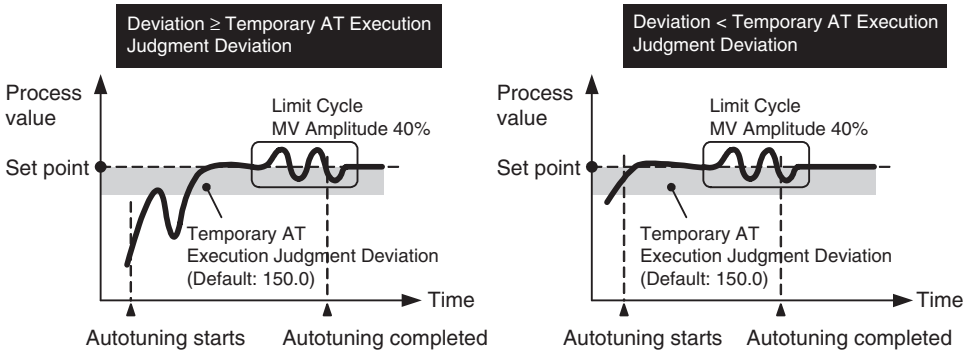
■ **Temporary AT Execution Judgment Deviation**

When autotuning has been executed, temporary autotuning will be executed if the deviation specified in this parameter is exceeded.

Note This parameter is disabled for 100% AT.

■ **40% AT**

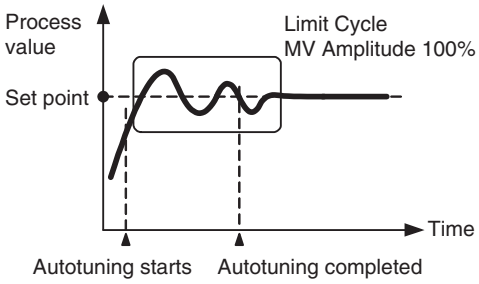
- The width of MV variation in the limit cycle can be changed with the Limit Cycle MV Amplitude parameter. In this case, autotuning will take longer to execute than it does with 100% AT.
- The timing of the limit cycle's onset depends on whether the deviation at the start of autotuning (DV) is less than the Temporary AT Execution Judgment Deviation.



■ **100% AT**

- When autotuning starts, it operates as shown below regardless of the deviation (DV). When you want to shorten the time it takes for autotuning, select 100% AT.

Note The Limit Cycle MV Amplitude and Temporary AT Execution Judgment Deviation parameters are disabled.



Self-tuning (ST) V1.2

Self-tuning (ST) finds the PID constants by using step response tuning (SRT) when the EJ1 is operated or the set point is changed.

Once the PID constants have been calculated, ST does not execute when the next control operation is started as long as the set point remains unchanged.

Variable type	Parameter name	Setting range	Default
E5/A5	ST (Channel)	0: Disabled 1: Enabled	0
	ST Stable Range (Channel)	–0.1 to 999.9 EU (See note 2.)	15.0

Conditions for use	The input type must be set to temperature input, control output must be assigned and set to standard control, the control method must be set to 2-PID control, remote SP must be disabled, and the Output ON Scheduling function must be disabled.

Note

(1) Settings can only be made when Unit is stopped.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

When using self-tuning, turn ON the power for the EJ1 and the power for the load (e.g., a heater) simultaneously, or turn ON the power for the load first. If the power is turned ON for the EJ1 before turning ON the power for the load, self-tuning will not be performed properly and optimum control will not be achieved.

Starting Conditions

Self-tuning by step response tuning (SRT) is started at the start of operation and when the set point is changed when the following conditions are met.

At start of operation	When the set point is changed
1. The set point at the start of operation differs from the set point when the previous SRT was executed. (See note 1.) 2. The difference between the temperature at the start of operation and the set point is greater than the higher value of either of the following: (Present proportional band 1.27 + 4°C) or the ST stable range. 3. The temperature at the start of operation is lower than the set point during reverse operation, and is larger than the set point during direct operation. 4. There is no reset from input errors.	1. The new set point differs from the set point used when the previous SRT was executed. (See note 1.) 2. The set point change width is greater than the larger value of either of the following: (Present proportional band 1.27 + 4°C) or the ST stable range. 3. During reverse operation, the new set point is larger than the set point before the change; and during direct operation, the new set point is smaller than the set point before the change. 4. The temperature is in a stable state (See note 2). (An equilibrium state is acceptable when the output is 0% at the time the power is turned ON. ((See note 3.))

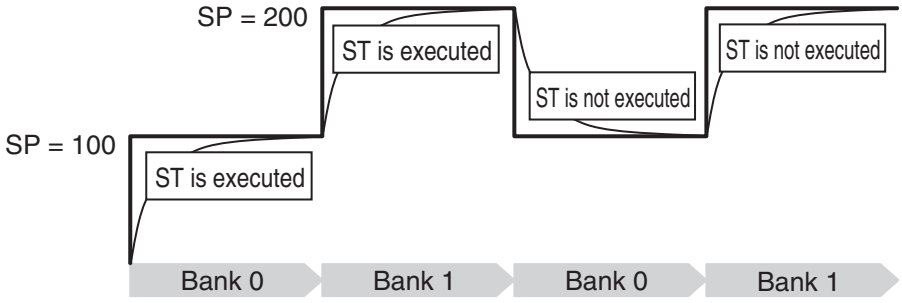
Note

1. The previous SRT-implemented set point is the set point that was used for calculating the PID constants for the previous SRT.
2. In this state, the measurement point is within the ST stable range.
3. In this state, the change width of the PV every 60 seconds is at the ST stable range or less.

In the following instances, PID constants are not changed by self-tuning (ST) for the present set point.

1. When the PID constants have been changed with ST enabled.
2. When autotuning (AT) has been executed.
3. When switching banks while starting ST.
   Stop self-tuning (ST) (PID constants are not changed). ST will not start even for banks that have been switched.

When banks have been switched, ST will be implemented for every bank when first operated. After the first operation, ST will not be implemented until the set points of selected banks have been changed.



⚠ **Caution**

- When ST is enabled, the following functions will be disabled.
  - SP ramp
  - MV limiter
  - While SRT is executing, the Disturbance Overshoot Adjustment Function will be disabled.
- When using this function, set the following parameters to their default settings: Output Scaling Upper Limit 1 to 4, Output Scaling Lower Limit 1 to 4, and Decimal Point C1 to C4. If these parameters are set to anything other than their defaults, ST will not operate properly.
- Switching to manual mode while ST is operating will cause ST to stop.
- When using ST, do not use MV calculation on the G3ZA.

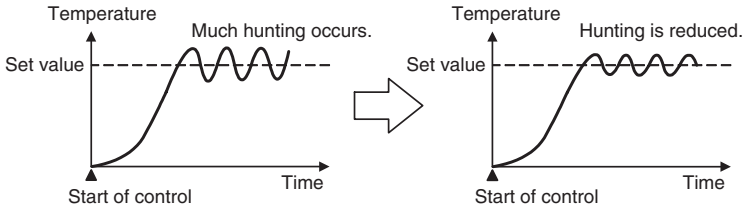
RT (Robust Tuning)

When autotuning or self-tuning **V1.2** is executed with RT selected, PID constants are automatically set that make it hard for control performance to degenerate even when control object's characteristics change.

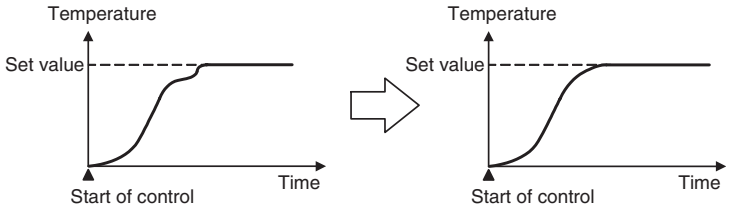
- Selecting the RT mode in the following cases will help to prevent hunting from occurring.
  - When the set temperature is not fixed and is changed in a wide range
  - When there are large variations in ambient temperatures due to factors such as seasonal changes or differences between day and night temperatures
  - When there are large variations in ambient wind conditions and air flow
  - When heater characteristics change depending on the temperature

- When an actuator with disproportional I/O, such as a phase-control-type power regulator, is used
- When a rapidly heating heater is used
- When the control object or sensor has a long dead time
- When hunting occurs in normal mode for any reason

- Even when hunting occurs for PID constants when AT/ST **V1.2** is executed in normal mode, it is less likely to occur when AT/ST **V1.2** is executed in RT mode.



- When the temperature (PV) falls short of the set point for the PID constants when using AT/ST **V1.2** in normal mode, executing AT/ST **V1.2** in RT mode tends to improve performance.



- When the manipulated variable (MV) is saturated, the amount of overshooting may be somewhat higher in comparison to PID control based on AT/ST **V1.2** in normal mode.

Switching to and from RT

Variable type	Parameter name	Setting range	Default
E5/A5	RT (Channel)	0: Disabled 1: Enabled	0

Conditions for use	The control method must be set to 2-PID control and the input type must be a temperature input.

Note This parameter can be set only when operation is stopped.

4-3-9 Disturbance Overshoot Adjustment Function

The Disturbance Overshoot Adjustment Function adjusts the control waveform when an external disturbance impacts the system.

- When using this function, set the Disturbance Overshoot Adjustment Function parameter to 1 (Enabled).
- The disturbance response waveform can be adjusted with the Disturbance Gain and Disturbance Time Constant parameters.

Variable type	Parameter name	Setting range	Default
E5/A5 (See note 1.)	Disturbance Overshoot Adjustment Function (Common)	0: Disabled 1: Enabled	0

Variable type	Parameter name	Setting range	Default
D5/95	Disturbance Gain (Channel)	−1.00 to 1.00	0.65
	Disturbance Time Constant (Channel)	0.01 to 99.99 s	1.00
	Disturbance Rectification Band (Channel)	0.0 to 999.9 EU (See note 2.)	0.0
	Disturbance Judgment Width (Channel)	−199.9 to 999.9 EU (See note 2.)	0.0

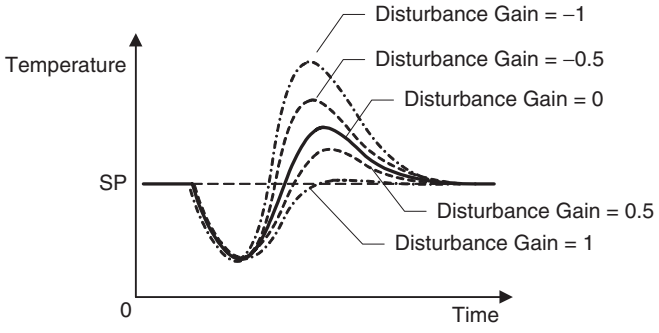
Conditions for use	The control method must be set to 2-PID control.

Note (1) This parameter can be set only when operation is stopped.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

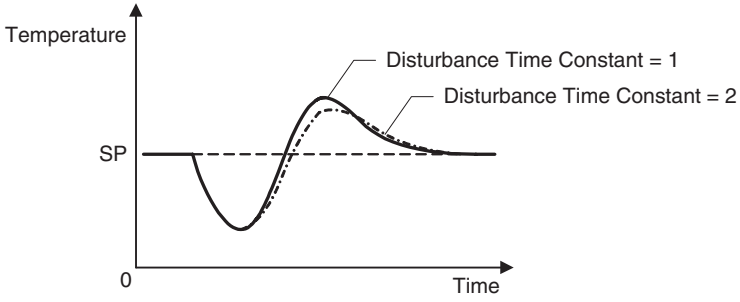
■ **Disturbance Gain**

- Overshooting due to a disturbance can be suppressed more by increasing the Disturbance Gain.
- Overshooting due to a disturbance can be increased by decreasing the Disturbance Gain.
- If the Disturbance Gain is set to 0, the Disturbance Overshoot Adjustment Function will not operate.



■ **Disturbance Time Constant**

The recovery time from the disturbance can be made longer by increasing the Disturbance Time Constant. The Disturbance Time Constant is normally left at its default setting of 1. Use this parameter for fine-tuning when adjusting the Disturbance Gain alone is not sufficient.

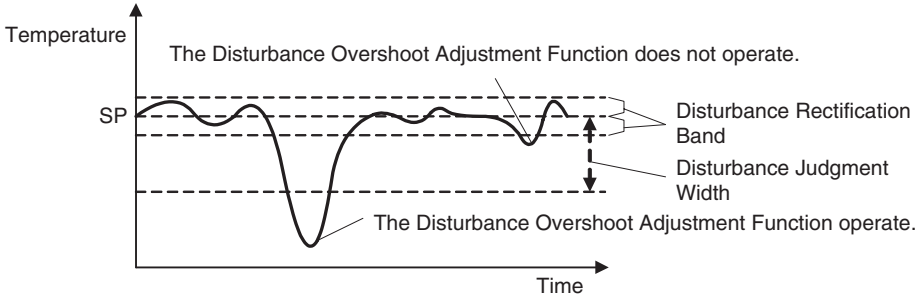


Note The waveform shown in the diagram above will vary depending on the control object's characteristics and the PID constant settings.

Starting Conditions for the Disturbance Overshoot Adjustment Function

The Disturbance Overshoot Adjustment Function will operate after the process value (PV) has stabilized in the Disturbance Rectification Band and the deviation is larger than the Disturbance Judgment Width.

- When the Disturbance Judgment Width is positive, the Disturbance Overshoot Adjustment Function will operate if a disturbance causes the process value (PV) to fall. When the Disturbance Judgement Width is negative, the Disturbance Overshoot Adjustment Function will operate if a disturbance causes the process value (PV) to rise.
- The Disturbance Overshoot Adjustment Function will not operate in the following situations:
  - When the Disturbance Rectification Band or Disturbance Judgment Width parameter is 0
  - When the set point is changed (when the set point change width exceeds the Disturbance Rectification Band)
  - During autotuning
  - During ON/OFF control
  - During PD control (I = 0.0)



4-3-10 Operation during Errors

This parameter can be used to select the operation when an error occurred.

Variable type	Parameter name	Setting range	Default
F0/B0	Operation During Error (Selection B) (Common)	0: Notification only (continue) 1: MV at PV Error 2: Stop control	0

Conditions for use	There must be a CT input.

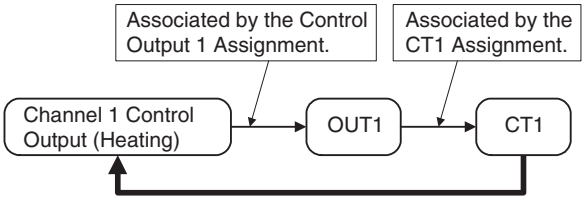
Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

- When setting 1 (MV at PV Error) is being used, set the MV at PV Error in variable type D5/95. For details, refer to *MV at PV Error* on page 77.
- If this parameter is set to 2: stop control, control will stop when an error occurs and will not be restored automatically even if the error is cleared. Execute the Reset Error operation command to restore operation.

- Each set value determines the operation for different errors, as shown in the following table.

Parameter name	Errors
Operation During Error (Selection B) (See note.)	• CT Heater Overcurrent • Heater Burnout (HB) Alarm • Heater Short (HS) Alarm • Heater Overcurrent (OC) Alarm

Note Applies to the channel associated with the CT (current transformer).
For example, when the Control Output 1 Assignment is set to Channel 1 Control Output (Heating) and the CT1 Assignment is set to OUT1, channel 1 will operate according to the Operation During Error (Selection B) setting if a heater burnout is detected at CT1.

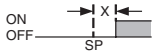
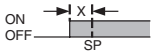
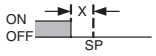
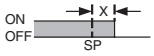
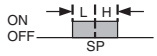
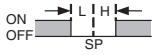
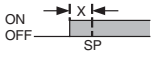
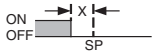
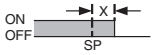
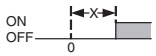
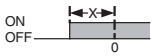
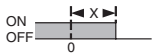
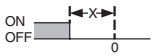
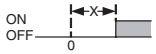
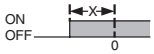
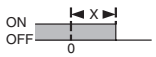
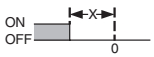


Since CT1 is associated with channel 1, channel 1 will operate according to the Operation During Error (Selection B) setting if an error is detected at CT1.

4-4 Setting Alarm Specifications

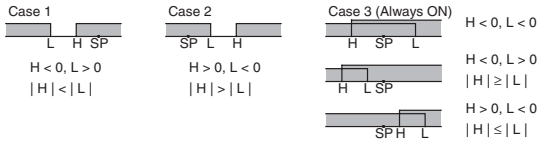
4-4-1 Alarm Types

Set the alarm type for each of the alarms in Alarm 1 Type, Alarm 2 Type, and Alarm 3 Type (variable type: E3/A3).

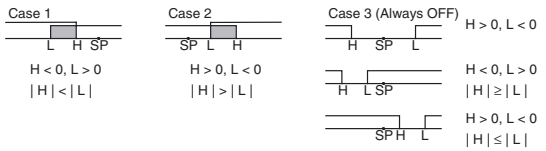
Set value	Alarm type	Alarm Output Function	
		When alarm value X is positive	When alarm value X is negative
0	Alarm function OFF	Output OFF	
1 (See note 1.)	Upper and lower limit		(See note 2.)
2 Default	Upper limit		
3	Lower limit		
4 (See note 1.)	Upper and lower-limit range		(See note 3.)
5 (See note 1.)	Upper and lower-limit alarm with standby sequence	(See note 5.) 	(See note 4.)
6	Upper-limit alarm with standby sequence		
7	Lower-limit alarm with standby sequence		
8	Absolute-value upper limit		
9	Absolute-value lower limit		
10	Absolute-value upper limit with standby sequence		
11	Absolute-value lower limit with standby sequence		
12	LBA (Loop Burnout Alarm)		

Note (1) With set values 1, 4 and 5, the upper and lower limit values can be set independently for each alarm type, and are expressed as “L” and “H.”

(2) Set value: 1, Upper and lower-limit alarm



(3) Set value: 4, Upper and lower-limit range



(4) Set value: 5, Upper and lower-limit with standby sequence

Note For the above upper and lower-limit alarm:

- In cases 1 and 2 above, the alarm is always OFF if the hysteresis overlaps the upper and lower limits.
- In case 3, the alarm is always OFF.

(5) Set value: 5, Upper and lower-limit with standby sequence

- The alarm is always OFF when the hysteresis overlaps the upper and lower limits.

4-4-2 Alarm Value

Alarm values are indicated by "X" in the table on the previous page. When the upper and lower limits are set independently, "H" is displayed for upper limit values, and "L" is displayed for lower limit values.

Variable type	Parameter name	Setting range	Default
D0/90	Alarm Value 1 to 3 (BANK)	–1999 to 9999 EU	0

Conditions for use	The alarm type must not be set to an upper and lower limit alarm, or to an LBA.

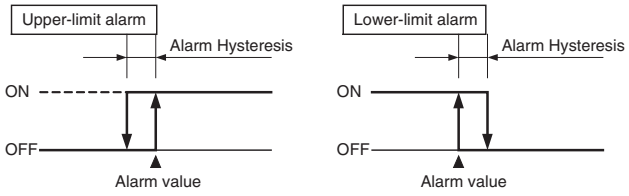
Variable type	Parameter name	Setting range	Default
D0/90	Alarm Upper Limit Value 1 to 3 (BANK)	–1999 to 9999 EU	0
	Alarm Lower Limit Value 1 to 3 (BANK)	–1999 to 9999 EU	0

Conditions for use	The alarm type must be set to an upper and lower limit alarm, upper and lower limit range alarm, or upper and lower limit alarm with standby sequence.

Note The decimal point position is determined by the sensor selection.
Refer to *4-7-1 Bank Function* for details on banks.

4-4-3 Alarm Hysteresis

- The hysteresis of alarm outputs when alarms are switched ON/OFF can be set as follows:



- Alarm hysteresis can be set separately for each alarm.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Hysteresis (Channel)	0.1 to 999.2 EU	0.2

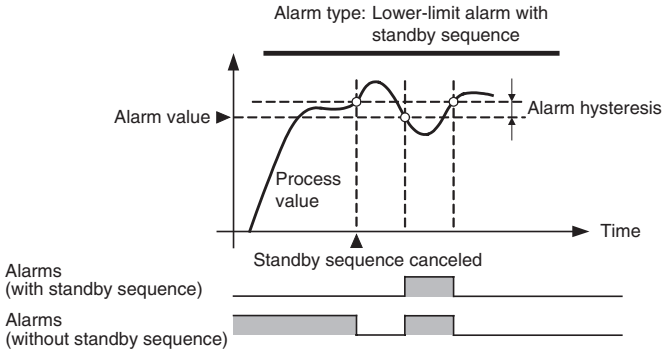
Conditions for use	The alarm type must not be set to 0.

Note This parameter can be set only when operation is stopped.
The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as setting 1 (***.*).

4-4-4 Standby Sequence

The standby sequence can be used so that an alarm will not be output until the process value leaves the alarm range once and then enters it again.

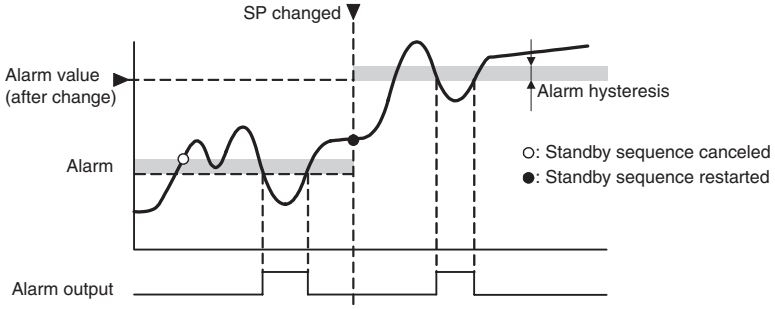
For example, with a lower limit alarm, the process value will normally be below the set point, i.e., within the alarm range, when the power supply is turned ON, causing an alarm to be output. If the lower limit alarm with standby sequence is selected, an alarm will not be output until the process value increases above the alarm set value, i.e., until it leaves the alarm range, and then falls back below the alarm value.



■ **Restarting the Standby Sequence**

- If an alarm is output, the standby sequence is canceled, but the standby sequence will start again after any of the following operations.

Restart conditions	• When control starts (including power ON) or when the alarm value (upper/lower-limit alarm value) or input shift value (upper/lower-limit temperature input shift value) is changed • When the set point is changed • When the bank is switched • When the alarm type is changed



4-4-5 Alarm Latch

The alarm latch can be used to keep an alarm ON once it goes ON.
The latch can be released to turn OFF the alarm by executing an operation command (Latch Cancel or Software Reset). Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Latch (Channel)	0: Disabled 1: Enabled	0

Conditions for use	The alarm type must not be set to 0.

Note This parameter can be set only when operation is stopped.

4-4-6 Closed in Alarm or Open in Alarm

When Close in Alarm is set, the alarm output function's status will be output as-is. When Open in Alarm is set, the alarm output function's status will be reversed before being output.

	Alarm Output Function	Alarm Output
Close in Alarm	ON	ON
	OFF	OFF
Open in Alarm	ON	OFF
	OFF	ON

The alarm output will be OFF (open) when the power is interrupted and for about 3 seconds after the power is turned ON, regardless of the Close in Alarm/Open in Alarm setting.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 Open in Alarm (Channel)	0: Closed 1: Open	0

Conditions for use	An alarm must be assigned to the control output.

Note This parameter can be set only when operation is stopped.

4-4-7 Alarm Delay

Delays can be set for the alarm outputs.

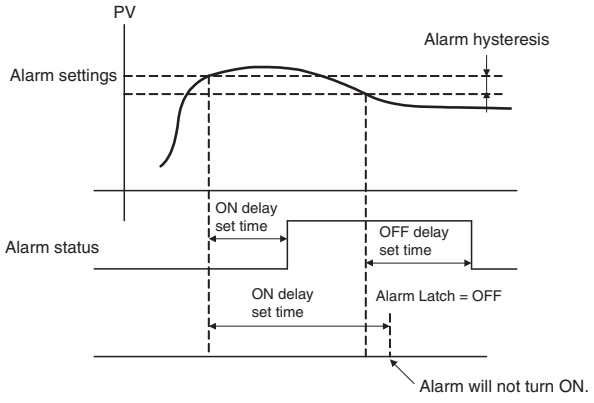
ON and OFF delays can be set for each alarm and also reflected in the Channel Alarm Status. The alarm's ON delay will also operate when the power is turned ON or a software reset is performed.

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 ON Delay (Channel)	0 to 999 Seconds	0
	Alarm 1 to 3 OFF Delay (Channel)	0 to 999 Seconds	0

Conditions for use	The alarm type must not be set to 0.

Note This parameter can be set only when operation is stopped.

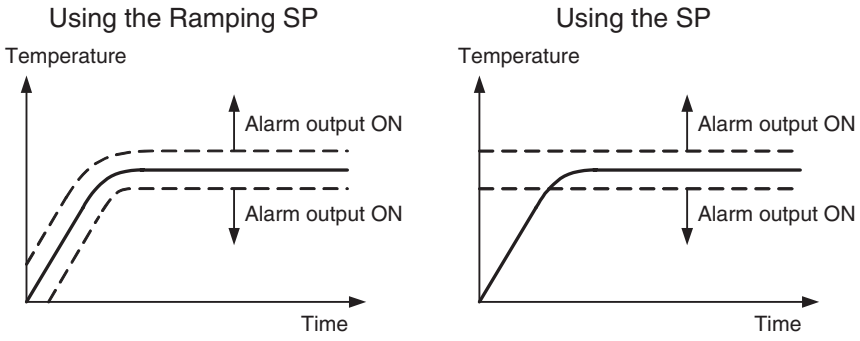
Operation of Alarm ON and OFF Delays (for an Upper-limit Alarm)



- The alarm will not turn ON if the time that the alarm is ON is equal to or less than the ON delay set time. Likewise, the alarm will not turn OFF if the time that the alarm is OFF is equal to or less than the OFF delay set time.
- If an alarm turns OFF and then back ON during the ON delay time, the time will be remeasured from the last time the alarm turns ON. Likewise, if an alarm turns ON and then back OFF during the OFF delay time, the time will be remeasured from the last time the alarm turns OFF.

4-4-8 Alarm SP Selection

During SP ramping, this parameter specifies whether alarm operation is performed on the ramping SP or the SP that will be reached after ramping.



Note The alarm type is set to 1 (Upper and lower limit).

Variable type	Parameter name	Setting range	Default
E3/A3	Alarm 1 to 3 SP Selection (Channel)	0: Ramping SP 1: SP	0

Conditions for use	The alarm type must be set to a deviation alarm, the SP Ramp function must be enabled, and ST must be disabled. **V1.2**

Note This parameter can be set only when operation is stopped.

4-4-9 Channel Alarm Status

The alarm status can be monitored.

Variable type	Parameter name	Setting range	Default
C4/84	Channel Alarm Status (Channel)	Refer to *Channel Alarm Status* on page 265.	---

Conditions for use	The alarm type must not be set to 0.

4-5 Detecting Current Errors

4-5-1 CT Assignment (TC2)

This parameter specifies which output's current is being measured.
Three-phase heater burnout detection can also be performed by assigning two CTs to one output.

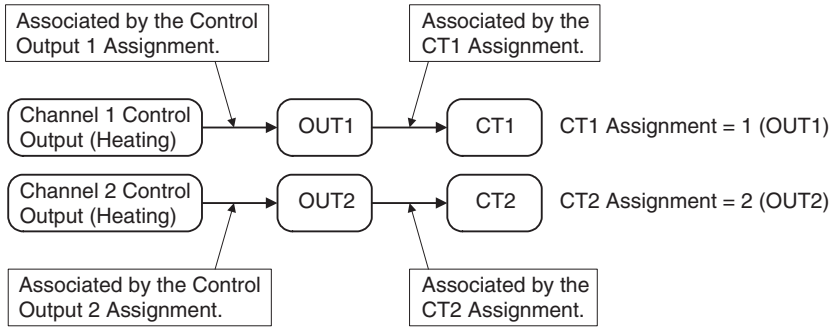
Variable type	Parameter name		Setting range	Default
E4/A4	CT1 Assignment	(I/O)	0: Disabled 1: Control output 1 2: Control output 2 3: Control output 3 4: Control output 4	1
	CT2 Assignment	(I/O)		2

Conditions for use	There must be a CT input.

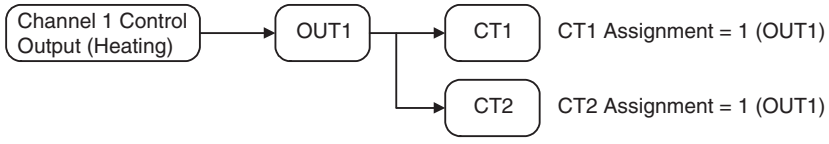
Note This parameter can be set only when operation is stopped.

■ **Examples:**

Example 1 Heater burnout detection is performed on each channel's control output (heating).


Associated by the Control Output 1 Assignment.
Associated by the CT1 Assignment.
Channel 1 Control Output (Heating)
OUT1
CT1
CT1 Assignment = 1 (OUT1)
Channel 2 Control Output (Heating)
OUT2
CT2
CT2 Assignment = 2 (OUT2)
Associated by the Control Output 2 Assignment.
Associated by the CT2 Assignment.

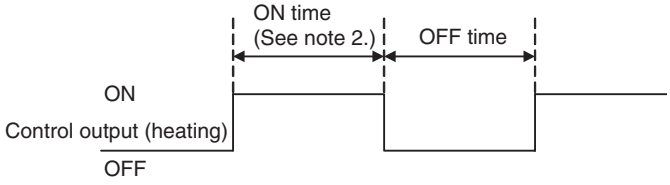
Example 2 Three-phase heater burnout detection is performed on channel 1's control output (heating).



4-5-2 Heater Burnout Alarm (HB Alarm)

A heater burnout is detected by measuring the heater current while the control output (heating) is ON. For details, refer to the following table. (Heater burnout detection cannot be used with the control output for cooling.)

Control output (heating)	Power to heater	HB Alarm output
ON	Yes (Normal) (See note 1.)	OFF
	No (Heater burnout)	ON



Note

(1) In the above diagram, power is considered to be ON (normal) if the heater current is greater than the heater burnout detection current during the ON time. If the heater is burned out, the current measured at the current transformer decreases. When the current falls below the channel's Heater Burnout Detection Value, a heater burnout alarm (HB Alarm) will be output.

(2) Heater burnouts are not detected if the control output (heating) ON time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

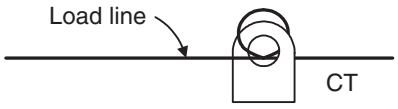
Variable type	Parameter name	Setting range	Default
D6/96 (See note 3.)	Heater Burnout 1 or 2 Detection (I/O)	0.0: HB Alarm OFF 0.1 to 99.9 A 100.0: HB Alarm ON	0.0
E4/A4 (See note 4.)	Heater Burnout 1 or 2 Hysteresis (I/O)	0.1 to 100.0 A	0.1
C5/85	Heater Current Value 1 or 2 Monitor (I/O)	0.0 to 110.0 A	---

Conditions for use	There must be a CT input.

(3) The HB Alarm can be forced OFF or ON, regardless of the actual heater current value, by setting the Heater Burnout Detection parameter to 0.0 or 100.0. Use the 0.0 and 100.0 settings to check operation.

(4) This parameter can be set only when operation is stopped.
The hysteresis setting prevents chattering at the detection point.

- Turn the heater ON before the EJ1, or turn both ON simultaneously. If the heater power is turned ON after turning ON the EJ1, the HB Alarm will be output.
- Control will be continued even when there is an HB Alarm.
- The rated current value may sometimes differ slightly from the actual current flowing to the heater. Check the current value in an actual operating state in the Heater Current Monitor Value 1 or 2 parameter.
- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through twice will double the detection current.



■ Heater Burnout Latch and Latch Cancel

The heater burnout alarm latch can be used to keep the HB Alarm ON once it goes ON.
The latch can be released by executing an operation command (Reset Error or Software Reset), cycling the power, or setting the Heater Burnout Detection Value to 0.0 A. Refer to *6-4-11 Operation Commands* for details on the operation commands.

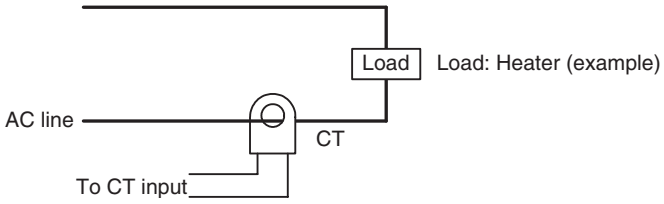
Variable type	Parameter name	Setting range	Default
E4/A4	Heater Burnout 1 or 2 Latch (I/O)	0: Disabled 1: Enabled	0

Note This parameter can be set only when operation is stopped.

Installing Current Transformers (CT) (HB Alarm)

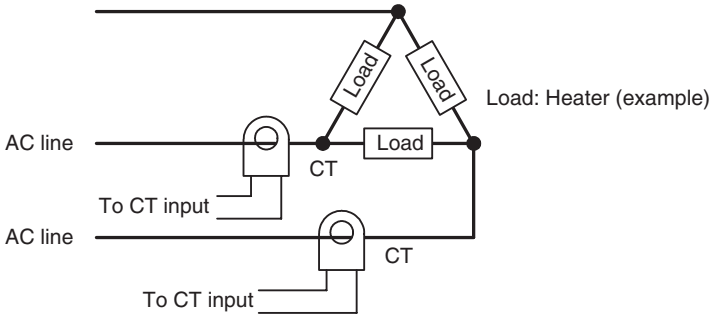
Connect the CT in advance to terminals A8 and A9 (CT1) or A7 and A9 (CT2), and pass the heater power line through the CT's hole. Refer to *Current Transformer* on page 232 for details on compatible CT specifications, models, and dimensions.

1. Single-phase Heaters
   Install the CT as shown below.



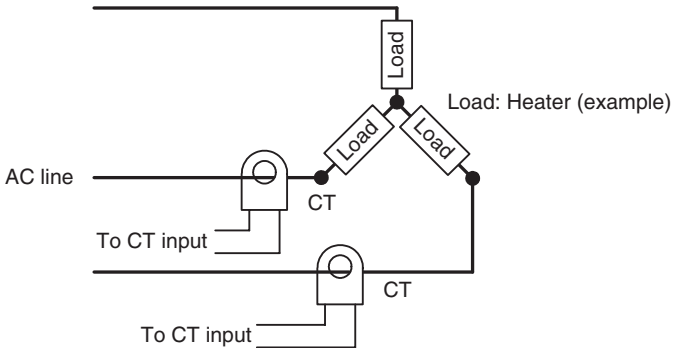
2. Three-phase Heaters
   Two CTs are required when using a three-phase power supply, regardless of the type of wiring.
   a. Delta Connection: Refer to the following diagram for CT installation positions.

   Note Heater voltage fluctuations are not considered here, so take that into account when setting the detection current.



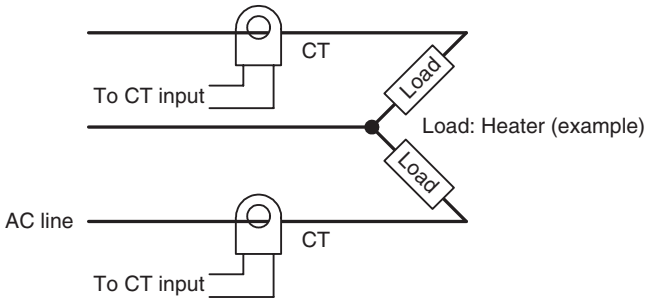
   b. Star Connection: Refer to the following diagram for CT installation positions.

   Note Heater voltage fluctuations are not considered here, so take that into account when setting the detection current.



   c. V Connection: Refer to the following diagram for CT installation positions.

   Note Heater voltage fluctuations are not considered here, so take that into account when setting the detection current.



Calculating the Heater Burnout Detection Current Value

Calculate the set value with the following equation:

$$\text{Set value} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

- To set the value of the heater burnout when two or more heaters are connected through the CT, use the current value of the smallest heater connected. (When all of the heaters have the same current value, use the current value when one of the heaters has burned out.)
- Be sure that the following conditions are satisfied:

  Heater with a current of less than 10.0 A:
  Current value at normal operation – Current value at heater burnout ≥ 1 A
  When the difference is less than 1 A, detection is unstable.

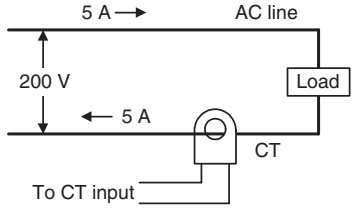
  Heater of current 10.0 A or more:
  Current value at normal operation – Current value at heater burnout ≥ 2.5 A
  When the difference is less than 2.5 A, detection is unstable.
- The setting range is 0.1 to 99.9 A. Heater burnout is not detected when the setting is 0.0 or 100.0. When the set value is 0.0, the HB alarm is turned OFF. When the set value is 100.0 the HB alarm is turned ON.
- Set the total current value at normal heater operation to 100 A or less.

■ **Examples**

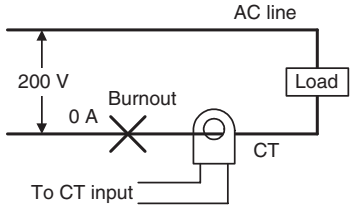
1. Single-phase Heaters

Example 1 Using a 200-VAC, 1-kW Heater

Normal operation



Heater burnout occurred



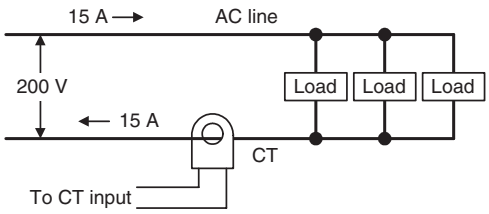
The heater current is 5 A when the current is normal, and 0 A when there is a burnout, so the heater burnout detection current is calculated as follows:

$$\therefore \text{Heater burnout detection current} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

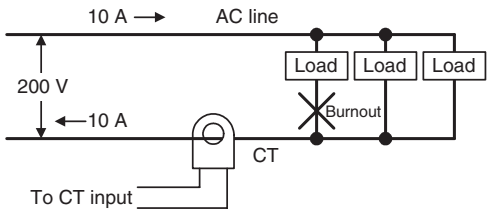
$$= \frac{5 + 0}{2} = 2.5 \text{ A}$$

Example 2 Using Three 200-VAC, 1-kW Heaters

Normal operation



Heater burnout occurred



The heater current is 15 A when the current is normal, and 10 A when there is a burnout, so the heater burnout detection current is calculated as follows:

$$\therefore \text{Heater burnout detection current} = \frac{\text{Normal current value} + \text{Burnout current value}}{2}$$

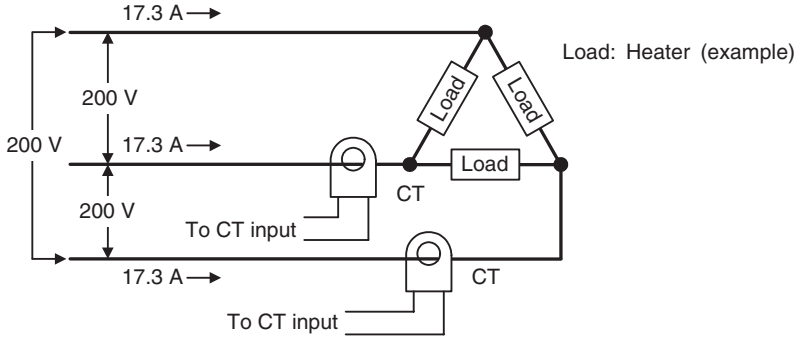
$$= \frac{15 + 10}{2} = 12.5 \text{ A}$$

2. Three-phase Heaters

   a. Delta Connection

   Example: Using Three 200-VAC, 2-kW Heaters

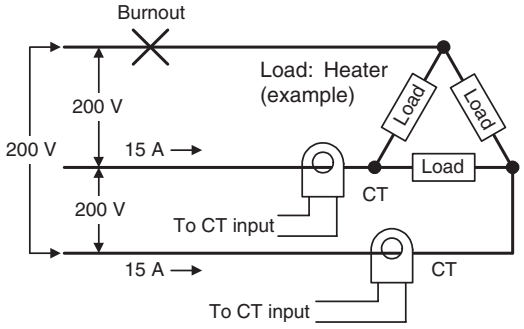
Normal Operation



When each phase's current is normal, the current is:

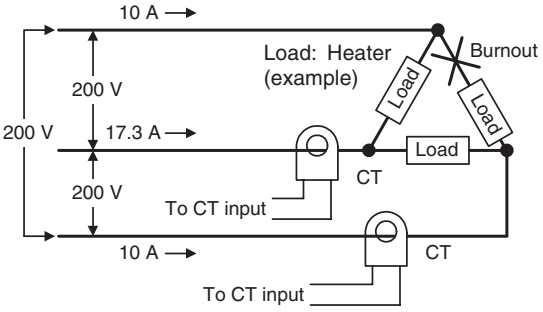
17.3 A ($\cong \sqrt{3} \times 10$ A).

Heater Burnout Occurred



Current when there is a burnout = $10 \text{ A} \times \sqrt{3} \times \left(\frac{\sqrt{3}}{2}\right)$

= 15 A



Current when there is a burnout = $10 \text{ A} \times \sqrt{3} \times \left(\frac{1}{\sqrt{3}}\right)$

= 10 A

The heater burnout current when there is a burnout at the load line is as follows:

$$\text{Heater burnout detection current} = \frac{17.3 + 15}{2} \cong 16.15 \text{ [A]}$$

The heater burnout current when there is a burnout at the load is as follows:

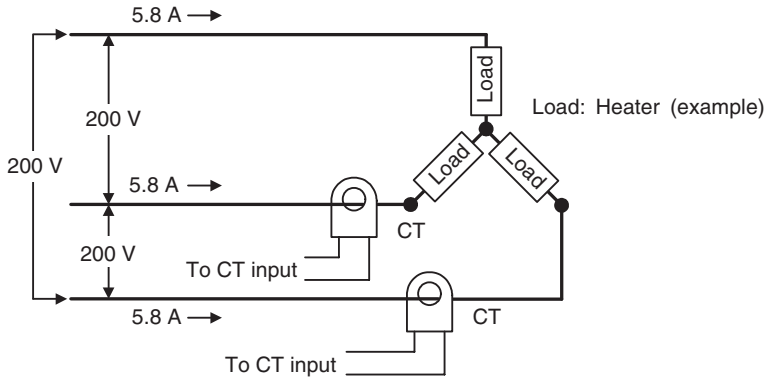
$$\text{Heater burnout detection current} = \frac{17.3 + 10}{2} \cong 13.65 \text{ [A]}$$

To enable detection in either case, use 16.1 A as the heater burnout detection current.

b. Star Connection

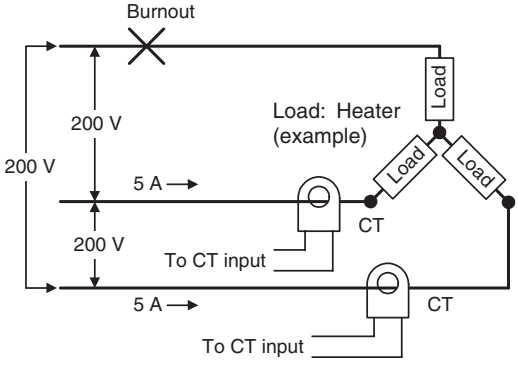
Example: Using Three 200-VAC, 2-kW Heaters

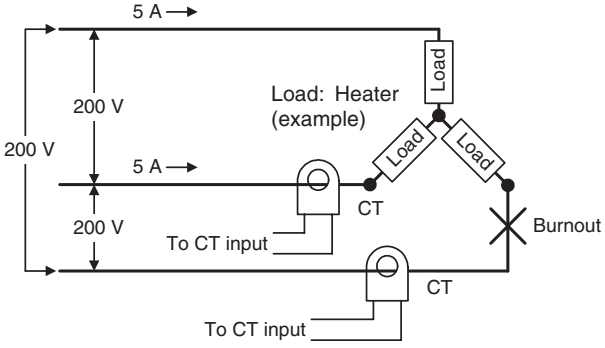
Normal Operation



When each phase's current is normal, the current is: 5.8 A $\left(\cong 10\ \text{A} \times \frac{1}{\sqrt{3}}\right)$.

Heater Burnout Occurred





Current when there is a burnout = $10\ \text{A} \times \left(\frac{1}{\sqrt{3}}\right) \times \left(\frac{\sqrt{3}}{2}\right)$

$= 5\ \text{A}$

Current when there is a burnout = $10\ \text{A} \times \left(\frac{1}{\sqrt{3}}\right) \times \left(\frac{\sqrt{3}}{2}\right)$

$= 5\ \text{A}$

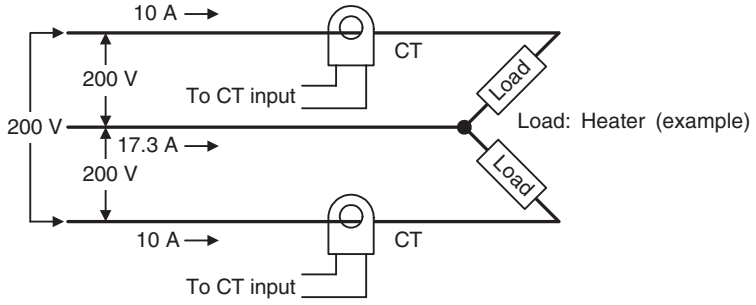
With this configuration, the heater burnout detection current is as follows:

$$\text{Heater burnout detection current} = \frac{5.8 + 5}{2} = 5.4\ [\text{A}]$$

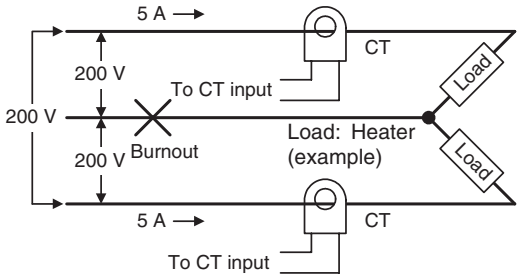
c. V Connection

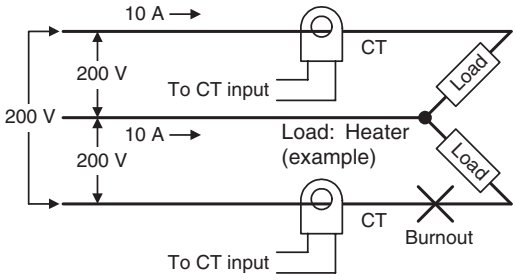
Example: Using Two 200-VAC, 2-kW Heaters

Normal Operation



Heater Burnout Occurred





Current when there is a burnout = 10 A × $\frac{1}{2}$ = 5 A

Current when there is a burnout = 0 A

The heater burnout current when there is a burnout at the common is as follows:

$$\text{Heater burnout detection current} = \frac{10 + 5}{2} \cong 7.5 \text{ [A]}$$

The heater burnout current when there is a burnout at the load is as follows:

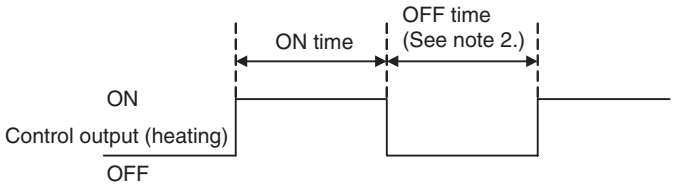
$$\text{Heater burnout detection current} = \frac{10 + 0}{2} \cong 5 \text{ [A]}$$

To enable detection in either case, use 7.5 A as the heater burnout detection current.

4-5-3 Heater Short Alarm (HS Alarm)

The HS Alarm detection function measures the heater current when the control output (heating) is OFF. For details, refer to the following table.
(HS Alarm detection cannot be used with the control output for cooling.)

Control output (heating)	Power to heater	HS Alarm output
OFF	Yes (HS alarm occurred)	ON
	No (Normal) (See note 1.)	OFF



Note (1) In the above diagram, power is considered to be OFF (normal) if the leakage current is less than the HS alarm current during the OFF time. If the SSR output is short-circuited, the measured current will increase beyond the HS alarm value and an HS Alarm will be output.

(2) HS alarms are not detected if the control output (heating) OFF time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

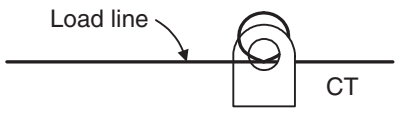
Variable type	Parameter name	Setting/monitoring range	Default
D6/96 (See note 3.)	HS Alarm 1 or 2 (I/O)	0.0: HS Alarm ON 0.1 to 99.9 A 100.0: HS Alarm OFF	100.0
E4/A4 (See note 4.)	HS Alarm 1 or 2 Hysteresis (I/O)	0.1 to 100.0 A	0.1
C5/85	Leakage Current Value 1 or 2 Monitor (I/O)	0.0 to 110.0 A	---

Conditions for use	There must be a CT input.

(3) The HS Alarm can be forced ON or OFF, regardless of the actual leakage current value, by setting the HS Alarm parameter to 0.0 or 100.0. Use the 0.0 and 100.0 settings to check operation.

(4) This parameter can be set only when operation is stopped.
The hysteresis setting prevents chattering at the detection point.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

- Control will be continued even when there is an HS Alarm.
- The rated current value may sometimes differ slightly from the actual current flowing to the heater. Check the current value in an actual operating state in the Leakage Current Value Monitor parameter.
- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through twice will double the detection current.



■ **HS Alarm Latch and Latch Cancel**

The HS alarm latch can be used to keep an HS alarm ON once it goes ON. The latch can be released by executing an operation command (Reset Error or Software Reset), cycling the power, or setting the HS Alarm parameter to 100.0 A. Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name	Setting range	Default
E4/A4	HS Alarm 1 or 2 Latch (I/O)	0: Disabled 1: Enabled	0

Note This parameter can be set only when operation is stopped.

Installing Current Transformers (CT) (HS Alarm)

For details, refer to *Installing Current Transformers (CT) (HB Alarm)* on page 93.

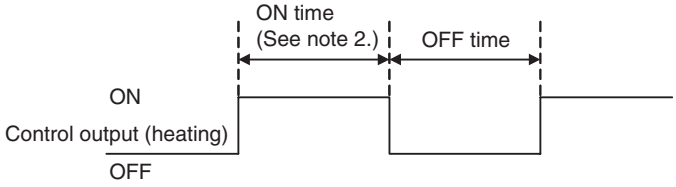
Calculating the Heater Short Detection Current Value

For details, refer to *Calculating the Heater Burnout Detection Current Value* on page 94.

4-5-4 Heater Overcurrent Alarm (OC Alarm)

A heater overcurrent is detected by measuring the heater current while the control output (heating) is ON. For details, refer to the following table.
(Heater overcurrent detection cannot be used with the control output for cooling.)

Control output (heating)	Power to heater	OC alarm output
ON	Normal (See note 1.)	OFF
	Heater overcurrent occurred	ON



Note

(1) In the above diagram, it is considered normal if the heater current is less than the heater overcurrent detection current. When an excessive current flows in the heater, the current will exceed the heater overcurrent detection value and a heater OC Alarm will be output.

(2) Heater overcurrents are not detected if the control output (heating) ON time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

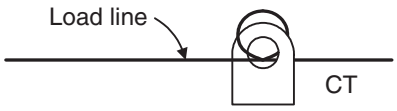
Variable type	Parameter name	Setting/monitoring range	Default
D6/96 (See note 3.)	Heater Overcurrent 1 or 2 Detection (I/O)	0.0: OC Alarm ON 0.1 to 99.9 A 100.0: OC Alarm OFF	100.0
E4/A4 (See note 4.)	Heater Overcurrent 1 or 2 Hysteresis (I/O)	0.1 to 100.0 A	0.1
C5/85	Heater Current Value 1 or 2 Monitor (I/O)	0.0 to 110.0 A	---

Conditions for use	There must be a CT input.

(3) The OC Alarm can be forced ON or OFF, regardless of the actual heater current value, by setting the OC (Heater Overcurrent) Alarm parameter to 0.0 or 100.0. Use the 0.0 and 100.0 settings to check operation.

(4) This parameter can be set only when operation is stopped.
The hysteresis setting prevents chattering at the detection point.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

- Control will be continued even when there is an OC Alarm.
- The rated current value may sometimes differ slightly from the actual current flowing to the heater. Check the current value in an actual operating state in the Heater Current Value 1 or 2 Monitor parameter.
- If there is little difference between the current in normal and abnormal states, detection may become unstable. To stabilize detection, set a current value difference of at least 1.0 A for heaters of less than 10.0 A, and at least 2.5 A for heaters of 10.0 A or more. If the heater current is too low, loop the load line several times through a CT, as shown in the diagram below. Looping it through twice will double the detection current.



■ **Heater Overcurrent Latch and Latch Cancel**

The heater overcurrent latch can be used to keep a heater OC Alarm ON once it goes ON.
The latch can be released by executing an operation command (Reset Error or Software Reset), cycling the power, or setting the Heater Overcurrent Detection Value to 100.0 A. Refer to *6-4-11 Operation Commands* for details on the operation commands.

Variable type	Parameter name	Setting range	Default
E4/A4	Heater Overcurrent 1 or 2 Latch (I/O)	0: Disabled 1: Enabled	0

Note This parameter can be set only when operation is stopped.

Installing Current Transformers (CT) (OC Alarm)

For details, refer to *Installing Current Transformers (CT) (HB Alarm)* on page 93.

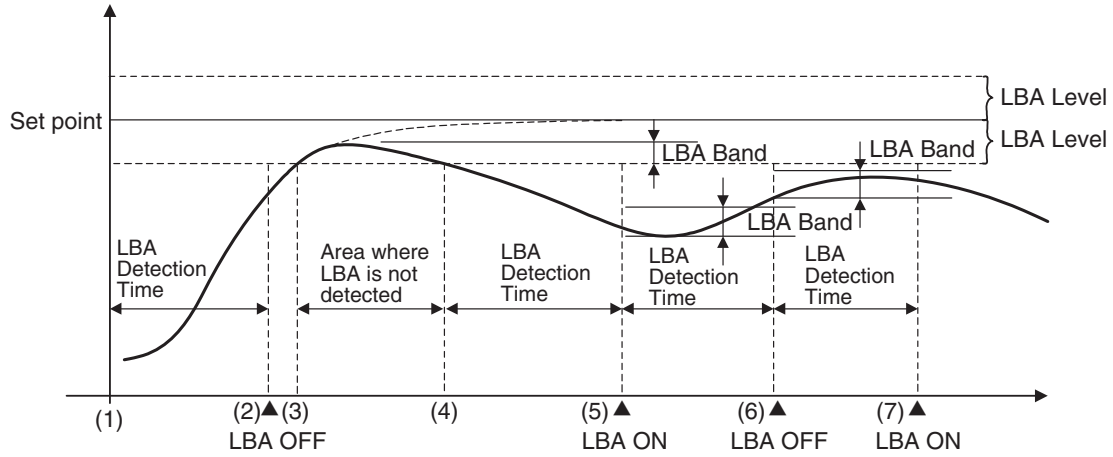
Calculating the Heater Overcurrent Detection Value

For details, refer to *Calculating the Heater Burnout Detection Current Value* on page 94.

4-6 Using the Loop Break Alarm (LBA)

4-6-1 Loop Burnout Alarm (LBA)

With a loop burnout alarm, there is assumed to be an error in the control loop if the control deviation (SP-PV) is greater than the threshold set in the LBA Level parameter and if the control deviation is not reduced by at least the value set in the LBA Band parameter within the specified LBA Detection Time.



- If the control deviation is reduced in the area between (1) and (2) (i.e., the set point is approached) and the control deviation is reduced by at least the LBA Band, the loop burnout alarm will remain OFF.
- The process value is within the LBA Level between (3) and (4), and thus loop burnout alarms will not be detected. (The loop burnout alarm will remain OFF.)
- If the process value is outside the LBA Level between (4) and (5) and the control deviation is not reduced by at least the LBA Band value within the LBA Detection Time, the loop burnout alarm will turn ON.
- If the control deviation is reduced in the area between (5) and (6) (i.e., the set point is approached) and the control deviation is reduced by at least the LBA Band value, the loop burnout alarm will turn OFF.
- If the control deviation is reduced in the area between (6) and (7) (i.e., the set point is approached) and the control deviation is reduced by less than the LBA Band value, the loop burnout alarm will turn ON.

Variable type	Parameter name		Setting range	Default
E3/A3	LBA Detection Time	(Channel)	0 to 9999 Seconds	0
	LBA Level	(Channel)	0.1 to 999.9 EU (See note 2.)	8.0
	LBA Band	(Channel)	0.0 to 999.9 EU (See note 2.)	3.0

Conditions for use	The alarm type must be set to 12.

Note

(1) This parameter can be set only when operation is stopped.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).
Refer to *4-7-1 Bank Function* for details on banks.

Determining the LBA Detection Time

- Automatic Settings

  The LBA detection time is set automatically by autotuning.
  (It is not set automatically for heating/cooling control.)

  If the optimum LBA detection time is not obtained by autotuning, set the LBA Detection Time parameter.

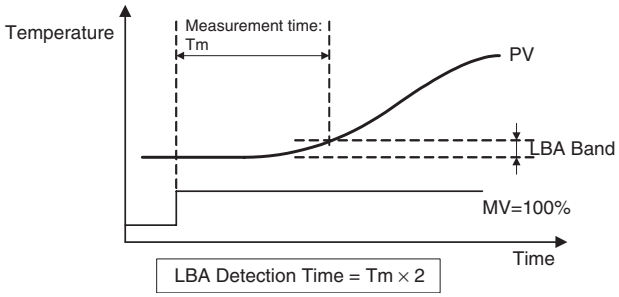
- Manual Settings

  To manually set the LBA detection time, set the LBA Detection Time parameter to twice the LBA reference time given below.

1,2,3...

(1) Set the output to the maximum value.

(2) Measure the time required for the width of change in the input to reach the LBA band.



(3) Set the LBA Detection Time parameter to two times the measured time.

Operating Conditions

- The LBA operates when one of the alarm types is set to LBA.
- Loop burnout alarms are not detected during SP ramping.
- Loop burnout alarms are not detected during autotuning, manual operation, or while stopped.
- If the LBA Detection Time, LBA Level, LBA Band, and PID settings are not appropriate, alarms may be detected inappropriately or alarms may not be output when necessary.
- Loop burnout alarms may be detected if unexpectedly large disturbances occur continuously and a large deviation does not decrease.
- If a loop burnout occurs when the set point is near the ambient temperature, the temperature deviation in a steady state may be less than the LBA level, preventing detection of the loop burnout.
- If the set point is so high or low that it cannot be reached even with a saturated manipulated variable, a temperature deviation may remain even in a steady state and a loop burnout may be detected.
- Detection is not possible if a fault occurs that causes an increase in temperature while control is being applied to increase the temperature (e.g., a solid-state relay short-circuit fault).
- Detection is not possible if a fault occurs that causes a decrease in temperature while control is being applied to decrease the temperature (e.g., a heater burnout fault).

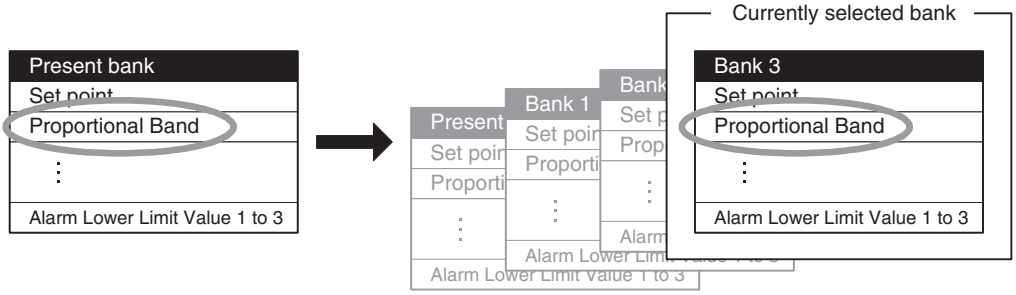
4-7 Other Functions (TC4 and TC2)

4-7-1 Bank Function

Up to 4 banks can be created with the following parameters registered independently.

- Set point
- Proportional Band
- Integral Time
- Derivative Time
- SP Ramp Rise Value
- SP Ramp Fall Value
- Manual Reset Value
- Cooling Coefficient
- Dead Band
- Alarm Value 1 to 3
- Alarm Upper Limit Value 1 to 3
- Alarm Lower Limit Value 1 to 3

The currently selected bank's parameters can be read or written by reading or writing the “Present Bank” parameters.



The following table shows the relationship between the banks and variable types.

Variable type	Bank
D0/90	Bank 0
D1/91	Bank 1
D2/92	Bank 2
D3/93	Bank 3
D4/94	Present Bank

Changing the Bank

The bank can be switched with an event input, internal bus, or operation command.

Changing the Bank With an Event Input

The bank can be switched by setting Bank (Bit 0) in the Event Input 1 Assignment and Bank (Bit 1) in the Event Input 2 Assignment, as shown in the following table.

Event input 2	Event input 1	Selected bank
OFF	OFF	Bank 0
OFF	ON	Bank 1
ON	OFF	Bank 2
ON	ON	Bank 3

Note Event input 1 can be used alone to switch between banks 0 and 1.

Internal Buses

The internal bus can be used to simultaneously switch the banks of linked Units. For details, refer to *4-7-3 Internal Buses (TC4 and TC2)*.

Operation Commands

For details, refer to *6-4-11 Operation Commands*.

■ **Bank Number**

The presently selected bank number can be checked with the following parameter.

Variable type	Parameter name		Setting range	Default
C4/84	Bank No. Monitor	(Channel)	0 to 3	---

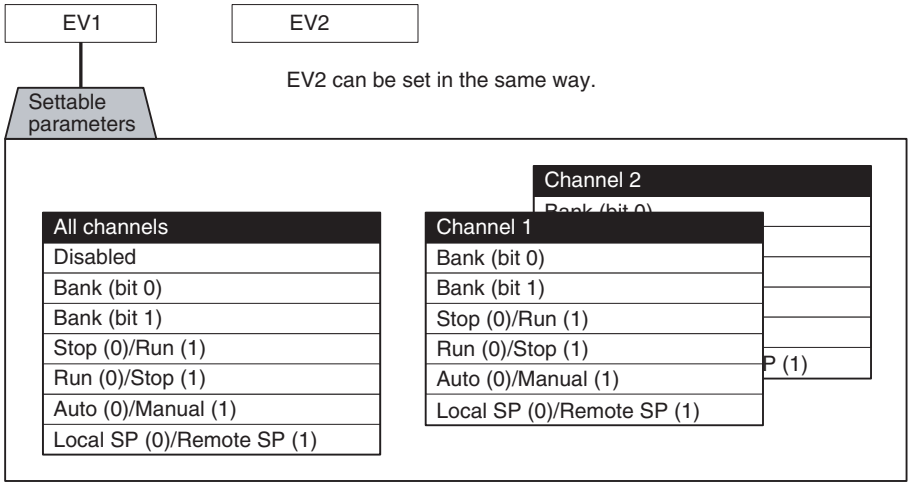
4-7-2 Event Inputs (TC2)

Event Input Assignment

There are two event inputs in the TC2.

The following diagram shows the parameters that can be set in event input 1 or event input 2.

Some of the parameters are for all channels and others are for individual channels.



Variable type	Parameter name	Setting range	Default
F2/B2	Event Input 1 or 2 Assignment (Common)	0 to 69	0

Conditions for use	No special conditions

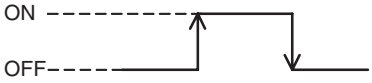
Note

(1) This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

(2) The event input status is read when the power supply is turned ON. This can result in unexpected operation at startup. Take sufficient precautions when using event inputs.

Controlling Operation with the Event Input's ON/OFF Status

- Operation can be switched by OFF-to-ON or ON-to-OFF event-input transitions.



■ **Stop (0)/Run (1), Run (0)/Stop (1), Auto (0)/Manual (1), Local SP (0)/ Remote SP (1)**

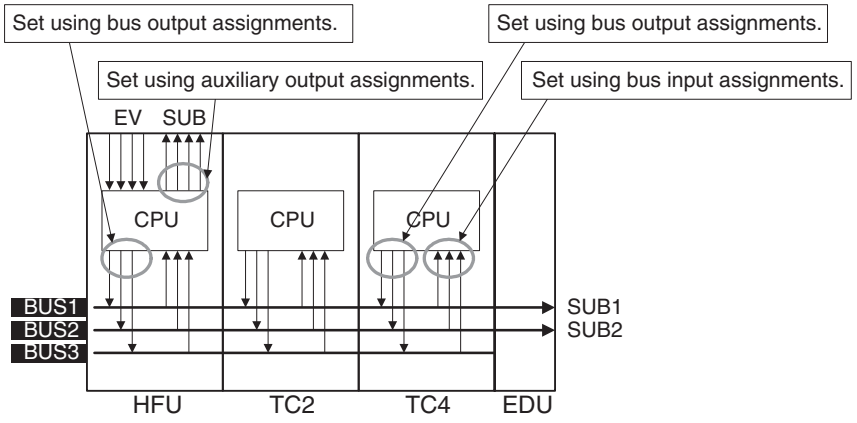
Parameter	Event input	Description
Stop (0)/Run (1)	OFF	Stop
	ON	Run
Run (0)/Stop (1)	OFF	Run
	ON	Stop
Auto (0)/Manual (1)	OFF	Auto
	ON	Manual
Local SP (0)/Remote SP (1) (See note.)	OFF	Local SP
	ON	Remote SP

Note This function can be used only when the Remote SP Enable parameter is set to 1 (Enable).

4-7-3 Internal Buses (TC4 and TC2)

The EJ1 has three built-in buses. I/O can be allocated to these buses, so simple sequences can be created by assigning signals that are output to the bus (Bus Output Assignments) and assigning functions that operate according to bus signals (Bus Input Assignments).

Note (1) Bus inputs cannot be used if a Basic Unit is used without an HFU. Even if an HFU is used, bus inputs cannot be used for Basic Units connected to the RS-485 communications lines using distributed positioning.



(2) BUS1 and BUS2 are connected to SUB1 and SUB2 on the EDU.

(3) HFU and TC2 event inputs and auxiliary outputs can be linked.

(4) Signals output to the bus can also be read at the outputting Unit itself.

(5) The bus I/O status is read when the power supply is turned ON. This can result in unexpected operation at startup. Take sufficient precautions when using bus I/O.

Bus I/O Assignments

The following diagrams show the parameters that can be set in the Bus Input 1 to 3 Assignment and Bus Output 1 to 3 Assignment parameters. Refer to the *Example* on page 108, when setting parameters.

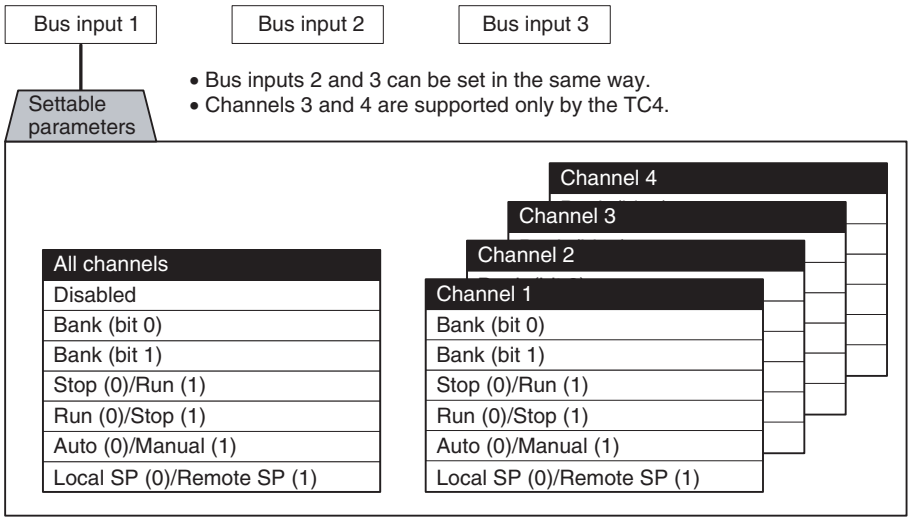
The settable parameters include those for all channels and those for individual channels.

Note

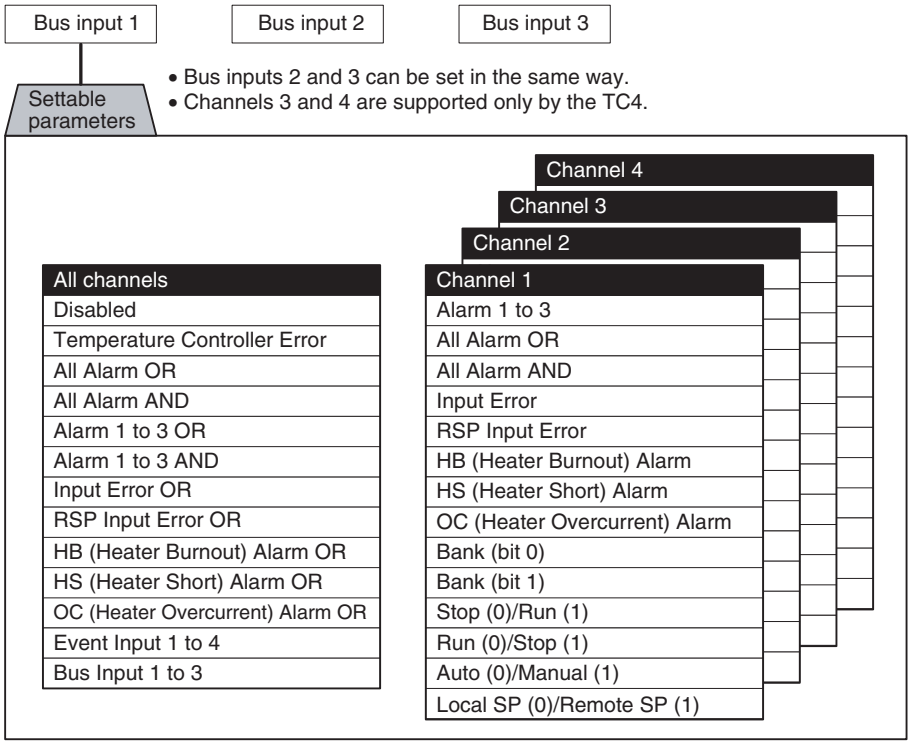
(1) Bus inputs cannot be used if a Basic Unit is used without an HFU. Even if an HFU is used, Bus Input cannot be used for TC Units connected to the RS-485 communications lines using distributed positioning.

(2) Set the bus settings correctly in each Unit so that there are no conflicts in operation within the EJ1 system.

■ Bus Input Assignments (TC4/TC2)



■ Bus Output Assignments (TC4/C2)



Note Temperature Controller Error
The Temperature Controller Error output will turn ON when an bit between bit 0 and bit 13 in the Device A Status is ON. It can be used to output EJ1 error status. Refer to *Status Lists* on page 256 for details on Device A Status.

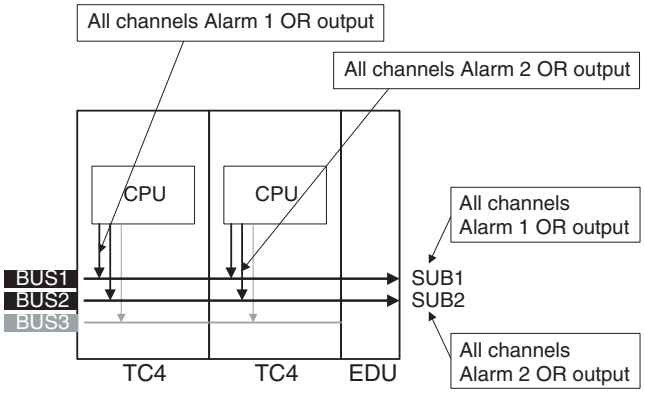
Variable type	Parameter name	Setting range	Default
F2/B2	Bus Input 1 to 3 Assignment (Common)	TC4: 0 to 132 TC2: 0 to 69	0
	Bus Output 1 to 3 Assignment (Common)	TC4: 0 to 150 TC2: 0 to 87	0

Conditions for use	No special conditions

Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

■ **Example**

Example: In this example, an All channels Alarm 1 OR output and an All channels Alarm 2 OR output are output to the End Unit's auxiliary outputs.



Model	Parameter name	Set values
TC4	Bus Output 1 Assignment	All channels Alarm 1 OR
	Bus Output 2 Assignment	All channels Alarm 2 OR

Note Refer to *4-4 Setting Alarm Specifications* for details on the alarm settings.

Note When assigning bus I/O, disable all bus I/O assignments first and then make the settings.

4-7-4 Using G3ZA Multi-channel Power Controllers

Note (1) Version 2 G3ZA Power Controllers can also be connected to version 1.0 EJ1 Temperature Controllers.

(2) When using ST, do not use MV calculation on the G3ZA. **V1.2**

Initial Settings

The following procedure is required in order to use a G3ZA. The G3ZA cannot be used in the condition in which it is shipped.

1,2,3... 1. Connect the G3ZA to a Basic Unit. Up to eight G3ZA Units can be connected to one Basic Unit. If more than eight Units are connected, a configuration error will occur.

2. Turn ON pin 7 of SW2 on the Basic Unit, set SW2 on the G3ZA to 3 (57.6 kbps), and set SW1 on the G3ZA to between 0 and 15 (unit number). The unit number of the G3ZA determines the MV sent from the Basic Unit. For details, refer to *Sending MVs to the G3ZA* on page 110.

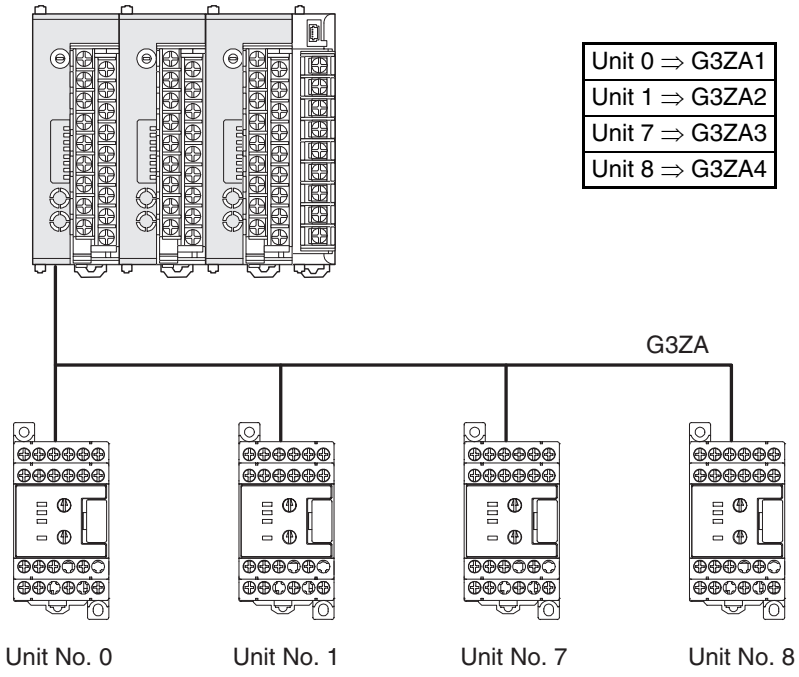
3. Turn ON the power supply to the Basic Unit and execute a Register Unit Configuration: Reset operation command. No G3ZA Units are registered in the default Basic Unit settings.
4. Turn OFF the power supply to the Basic Unit and then turn ON the power supply in the following order: G3ZA Units and then the Basic Unit. When the Basic Unit starts, it will automatically scan for connected G3ZA Units.
5. Check the Configuration Error A Status to see if any errors have occurred. If there are no errors, execute a Register Unit Configuration: Register operation command. Always execute this command. If the configuration is not registered correctly and the configuration cannot be recognized correctly, unexpected outputs may occur from the G3ZA Power Controllers for the outputs from the Basic Units.

Connection Example

When the EJ1 starts, it scans the connected G3ZA Power Controllers and automatically assigns names G3ZA1, G3ZA2, etc., in order starting with the lowest unit number.

Example: In this example, the G3ZA Units have been set to unit numbers 0, 1, 7, and 8.

The following diagram shows how the G3ZA Units are associated with the EJ1.



Unit number	Variable type	Parameter name
0	DA/9A	G3ZA1 - CH1 Slope
		G3ZA1 - CH1 2 Slope
		⋮
1		G3ZA2 - CH1 Slope
		G3ZA2 - CH1 2 Slope
		⋮
7		G3ZA3 - CH1 Slope
		G3ZA3 - CH1 2 Slope
		⋮
8		G3ZA4 - CH1 Slope
		G3ZA4 - CH1 2 Slope
		⋮

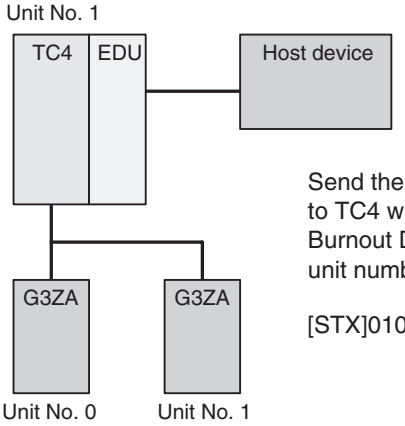
Settings

The G3ZA settings are read and written through the Basic Unit.

The Basic Unit has addresses allocated in its variable area for use with the G3ZA. The G3ZA set values can be read and written by reading and writing that variable area. Refer to *Parameter List* on page 235 for details on the variable area for the G3ZA. Refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No. Z200) for details on the corresponding functions and settings.

■ Example

In this example, G3ZA settings are changed.



Send the following command from the host device to TC4 when setting the Channel 2 Heater Burnout Detection Value to 10 A in the G3ZA with unit number 1.

[STX]0100001029A0219000001000A[ETX][BCC]

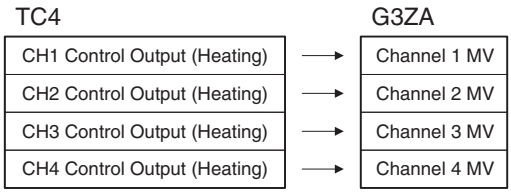
Sending MVs to the G3ZA

The G3ZA's unit number and model determine which MVs are sent from the EJ1 to the G3ZA.

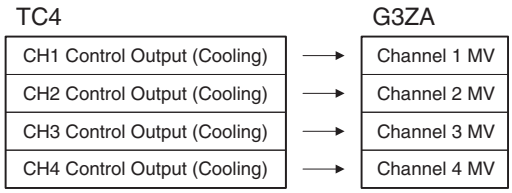
G3ZA Models with 4 Channels

The EJ1 uses the G3ZA's unit number to determine whether to send heating outputs or cooling outputs.

• G3ZA Units with unit numbers 0 to 7



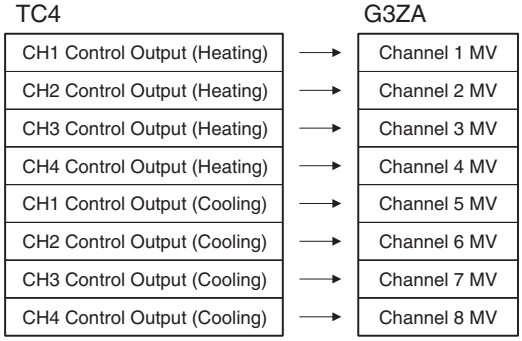
• G3ZA Units with unit numbers 8 to 15



Note With a TC2, the Channel 3 and 4 MVs will be set to 0.0%.

G3ZA Models with 8 Channels

The following outputs will be sent whether the control method is set to standard or heating/cooling control.



Note

(1) When standard control is being used, the Channel 5 to 8 MVs will be set to 0.0%.

(2) With a TC2, the Channel 3, 4, 7, and 8 MVs will be set to 0.0%.

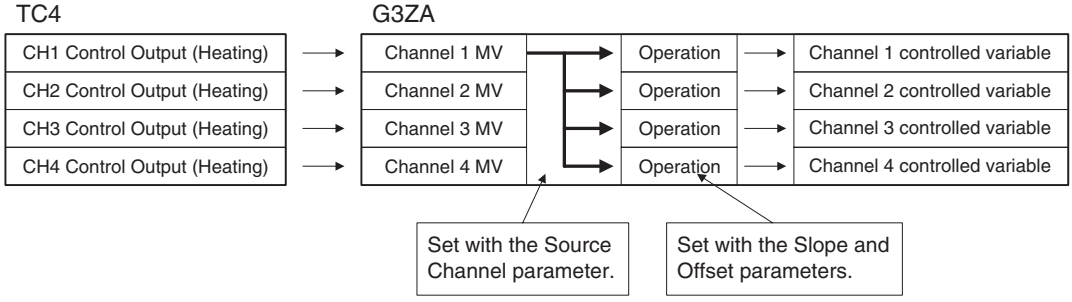
MVs Output from the G3ZA

The outputs of predetermined channels are set in the G3ZA's MV, but any MV can be output to multiple channels by setting the G3ZA's "Source Channel." Arithmetic operations can also be executed on each MV.

⚠ **Caution** If the MV is stored or calculated at the G3ZA and the G3ZA is turned ON before the EJ1, the controlled variable produced at the G3ZA will be output (the output may not be 0.0%) until the EJ1 starts operating. When using MV storage or MV calculation, verify that the controlled variable produced by the G3ZA is appropriate.

■ Example

In this example, the TC4's channel 1 Control output (heating) is output to G3ZA channels 1 to 4.



G3ZA settings	Set value
CH1 Source Channel	1
CH2 Source Channel	1
CH3 Source Channel	1
CH4 Source Channel	1

4-7-5 Using the G3PW V1.1

Initial Settings

The G3PW cannot be used in the condition in which it is shipped. Make the following settings.

1,2,3...

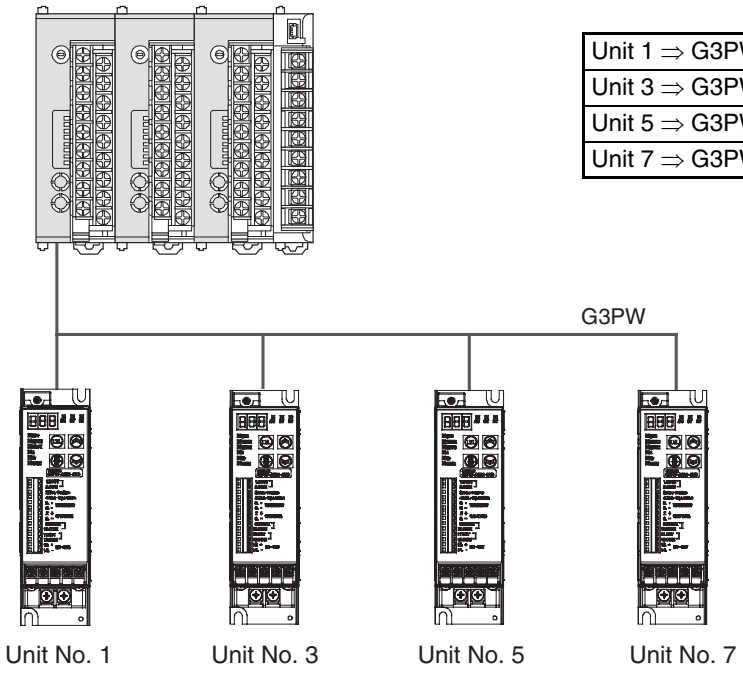
1. Connect the G3PW to a Basic Unit.
   Up to eight Units can be connected to one Basic Unit. If more than eight Units are connected, a configuration error will occur. G3PW Units and G3ZA Units cannot be used in combination.
2. Turn ON pin 7 of SW2 on the Basic Unit, and make the following settings: Set the main setting auto/manual switch on the G3PW to auto (0), set the event input allocation to no allocation (0) or control method switch (1), set the main setting auto input switch to communications (1), set the main setting auto/manual switch default mode to auto (0), set the baud rate to 57.6 kbps (3), set the communications unit No. between 1 and 8, and set the communications main setting acquisition number from 0 to 8. For information on the communications main setting acquisition number, refer to *MV Output from the G3PW* on page 114.
   Settings can be made for the G3PW using key operations. For details refer to the *G3PW Power Controller User's Manual* (Cat. No. Z280).
3. Turn ON the power supply to the Basic Unit and execute a Register Unit Configuration: Reset operation command. No G3ZA Units are registered in the default Basic Unit settings.
4. Turn OFF the power supply to the Basic Unit and then turn ON the power supply in the following order: G3PW Units and then the Basic Unit. When the Basic Unit starts, it will automatically scan for connected G3PW Units.
5. Check the Configuration Error A Status to confirm that no errors have occurred, then execute a Register Unit Configuration: Register operation command. Always execute this command. If the configuration is not registered correctly and the proper configuration cannot be recognized, unexpected outputs may occur from the G3PW Power Controllers for the outputs from the Basic Units.

Connection Example

When the EJ1 starts, it scans the connected G3PW Power Controllers and automatically assigns names to them, such as G3PW1, G3PW2, etc., in order starting with the lowest communications unit number.

Example: In this example, the Communications Units for the G3PW have been set to unit numbers 1, 3, 5, and 7.

The following diagram shows the relationship between the G3PW Units and the EJ1.



Communications unit No.	Variable type	Parameter name
1	DA/9A	G3PW1 - Internal Duty Setting
		G3PW1 - Base-up Value
		⋮
3		G3PW2 - Internal Duty Setting
		G3PW2 - Base-up Value
		⋮
5		G3PW3 - Internal Duty Setting
		G3PW3 - Base-up Value
		⋮
7		G3PW4 - Internal Duty Setting
		G3PW4 - Base-up Value
		⋮

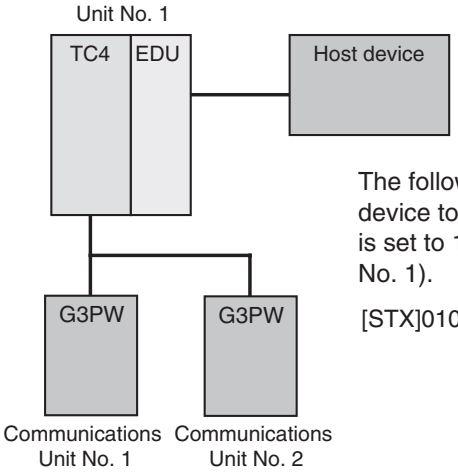
Settings

The G3PW settings are read and written through the Basic Unit.

The Basic Unit has addresses for the G3PW allocated in its variable area. The G3PW set values can be read and written by reading and writing this variable area. Refer to the *Parameter List* on page 235 for details on the variable area for the G3PW. Refer to the *G3PW Power Controller User's Manual* (Cat. No. Z280) for details on functions and settings.

■ Setting Example

In this example, G3PW settings are changed.



The following command is sent from the host device to TC4 when the Heater Burnout Threshold is set to 10% in the G3PW (communications unit No. 1).

[STX]0100001029A0206000001000A[ETX][BCC]

MV Sent to the G3PW

The following MV will be sent from the EJ1 to the G3PW Unit regardless of whether the control method is set to standard or heating/cooling control.

TC4		G3PW
CH1 Control Output (Heating)	→	CH1 Control Output (Heating)
CH2 Control Output (Heating)	→	CH2 Control Output (Heating)
CH3 Control Output (Heating)	→	CH3 Control Output (Heating)
CH4 Control Output (Heating)	→	CH4 Control Output (Heating)
CH1 Control Output (Cooling)	→	CH1 Control Output (Cooling)
CH2 Control Output (Cooling)	→	CH2 Control Output (Cooling)
CH3 Control Output (Cooling)	→	CH3 Control Output (Cooling)
CH4 Control Output (Cooling)	→	CH4 Control Output (Cooling)

Note

(1) When standard control is being used, the Channel 1 to 4 control outputs for cooling are set to 0.0%.

(2) With a TC2, the Channel 3 and 4 control outputs for heating and cooling are set to 0.0%.

MV Output from the G3PW

The MV of any desired channel can be output by setting the communications main setting acquisition number on the G3PW. By setting the communications main setting acquisition number from 1 to 8, the MV for the set number can be acquired from among the sent MVs, and the corresponding output can be made. If the communications main setting acquisition number is set to 0, the MV corresponding to the communications unit No. will be acquired and output. It is also possible to set Base-up Value, and Output Upper Limit or Output Lower Limit.

Communications main setting acquisition number	Output MV
0	Automatic Assignment (according to the communications unit No.)
1	CH1 Control Output (Heating)
2	CH2 Control Output (Heating)
3	CH3 Control Output (Heating)
4	CH4 Control Output (Heating)
5	CH1 Control Output (Cooling)
6	CH2 Control Output (Cooling)

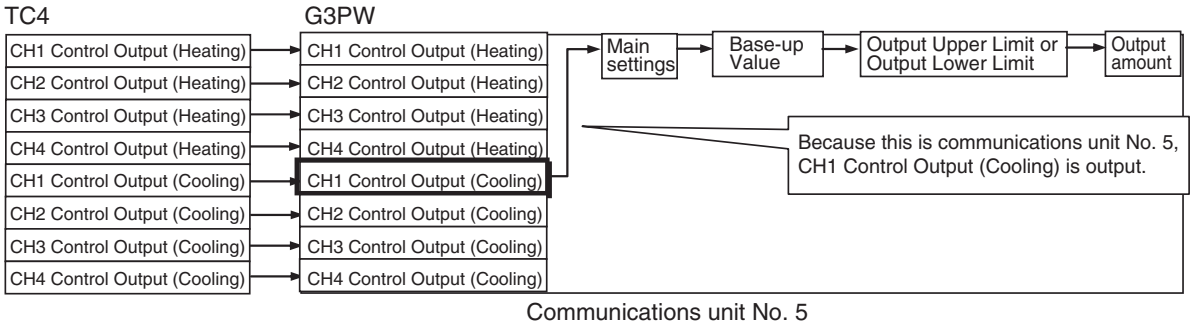
Communications main setting acquisition number	Output MV
7	CH3 Control Output (Cooling)
8	CH4 Control Output (Cooling)

⚠Caution When a base increase amount, Output Upper Limit, or Output Lower Limit has been set with the G3PW, the output value calculated by the G3PW will be output (the output may be something other than 0.0%) until the time that the EJ1 starts operating. Take this into consideration when making these settings.

■ Setting Example

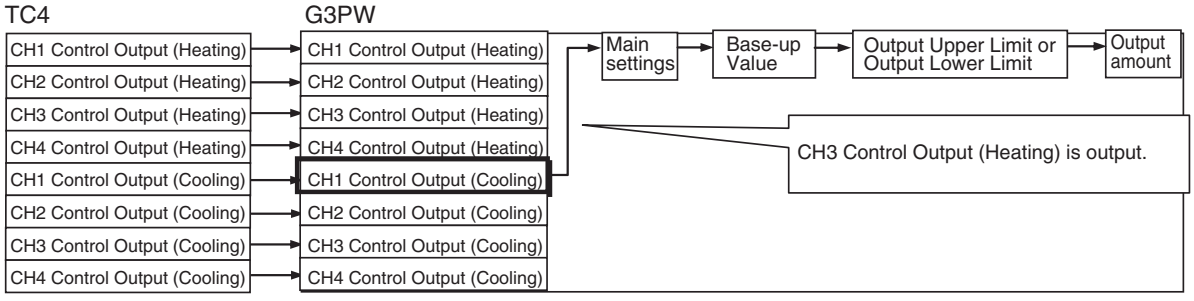
In this example, the TC4 control output is output to the G3PW.

1. When the communications main setting acquisition number is set to Auto (0).


TC4
G3PW
CH1 Control Output (Heating)
CH2 Control Output (Heating)
CH3 Control Output (Heating)
CH4 Control Output (Heating)
CH1 Control Output (Cooling)
CH2 Control Output (Cooling)
CH3 Control Output (Cooling)
CH4 Control Output (Cooling)
Main settings
Base-up Value
Output Upper Limit or Output Lower Limit
Output amount
Because this is communications unit No. 5, CH1 Control Output (Cooling) is output.

Communications unit No. 5

2. When the communications main setting acquisition number is set to 3: CH3 Control Output (Heating).



SECTION 5
Advanced Unit (HFU) Functions

This section describes the functions of EJ1 Advanced Unit.

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5-3 Other HFU Functions 166
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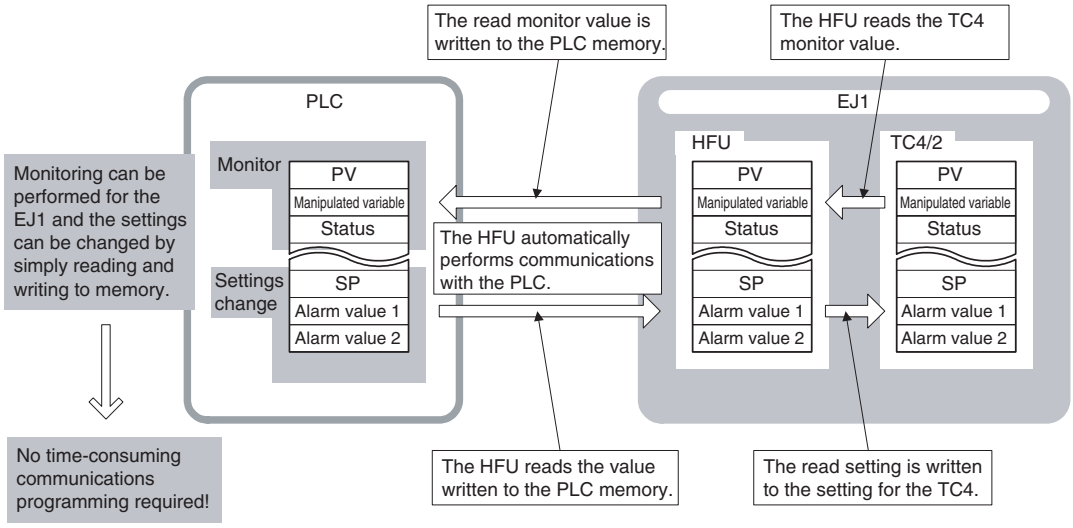
5-1 Programless Communications

Communications with PLCs from OMRON (SYSMAC CS/CJ Series) and Mitsubishi Electric (MELSEC-Q/QnA/QnAS/An/AnS/FX3UC Series) can be performed without creating ladder programs.

Using programless communications enables monitoring and changing settings for the EJ1 by simply reading and writing to PLC memory. The EJ1 automatically performs communications with PLCs so no time-consuming communications programming is required.


The read monitor value is written to the PLC memory.
The HFU reads the TC4 monitor value.
PLC
EJ1
HFU
TC4/2
Monitor
Settings change
PV
Manipulated variable
Status
SP
Alarm value 1
Alarm value 2
Monitoring can be performed for the EJ1 and the settings can be changed by simply reading and writing to memory.
The HFU automatically performs communications with the PLC.
No time-consuming communications programming required!
The HFU reads the value written to the PLC memory.
The read setting is written to the setting for the TC4.

5-1-1 Connectable Devices

SYSMAC CS/CJ Series/ CP1 Series

Name	Model	Communications port	
		Port 1	Port 2
Serial Communications Unit	CJ1W-SCU21-V1	RS-232C	RS-232C
	CJ1W-SCU31-V1	RS-422A/485	RS-422A/485
	CJ1W-SCU41-V1	RS-422A/485	RS-232C
	CS1W-SCU21-V1 (See note.)	RS-232C	RS-232C
Serial Communications Board	CS1W-SCB21-V1 (See note.)	RS-232C	RS-232C
	CS1W-SCU31-V1	RS-422A/485	RS-422A/485
	CS1W-SCB41-V1 (See note.)	RS-232C	RS-422A/485
CPU Unit	CS/CJ Series	---	RS-232C
	CP1 Series	RS-232C or RS-422A/485 (See note 4.)	RS-232C or RS-422A/485 (See note 4.)

Note

(1) Use only products manufactured on or after December 20, 1999. For details, refer to the *CS/CJ Series Serial Communications Boards/ Units* Operation Manual (Cat. No. W336).

(2) Programless communications may stop if a momentary power interruption occurs at the CPU Unit when programless communications are being used for a communications port on the CPU Unit. If they do stop, either cycle the EJ1 power supply or execute a software reset.

(3) Use an RS-422A/485 port for 1:N connections.

(4) An Option Board (sold separately) is required.

MELSEC-Q/QnA/QnAS Series

Name	Model	Communications port	
		Channel 1	Channel 2
Q-compatible Serial Communications Unit	QJ71C24N QJ71C24	RS-232C	RS-422/485
	QJ71C24N-R2 QJ71C24-R2	RS-232C	RS-232C
	QJ71C24N-R4	RS-422/485	RS-422/485
QnA-compatible Serial Communications Unit	A1SJ71QC24N	RS-232C	RS-422/485
	A1SJ71QC24N-R2	RS-232C	RS-232C
QnAS-compatible Serial Communications Unit	A1SJ71QC24N	RS-232C	RS-422/485
	A1SJ71QC24N-R2	RS-232C	RS-232C

Note Direct connections to the EJ1 are possible only with RS-232C or RS-422.

MELSEC-An/AnS Series
V1.1

Name	Model	Communications port
An-compatible Computer Link Unit	AJ71UC24	RS-232C or RS-422/485
AnS-compatible Computer Link Units	A1SJ71UC24-R2	RS-232C
	A1SJ71UC24-R4	RS-422/485
	A1SJ71UC24-PRF	RS-232C

Note Use an AnA or AnU CPU Module.

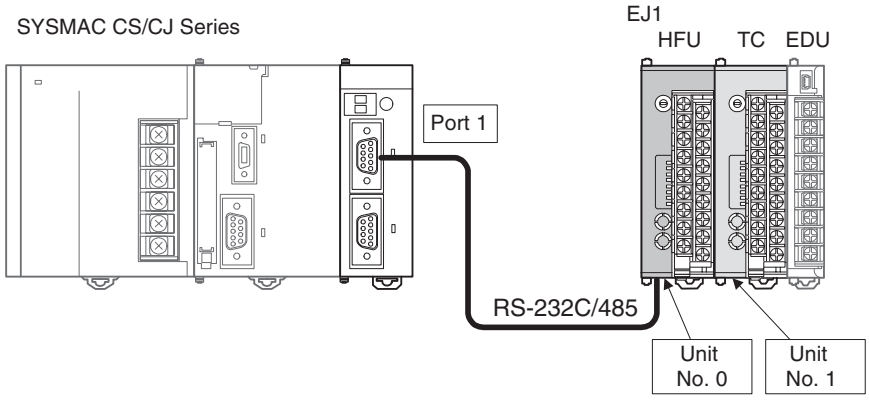
MELSEC-FX3UC Series
V1.1

Name	Model	Communications port
Communication Special Adapter	FX3U-232ADP	RS-232C
	FX3U-485ADP	RS-485
Function Expansion Board	FX3U-232-BD	RS-232C
	FX3U-485-BD	RS-485

5-1-2 Checking Operation

Checking Operation with SYSMAC CS/CJ Series PLCs

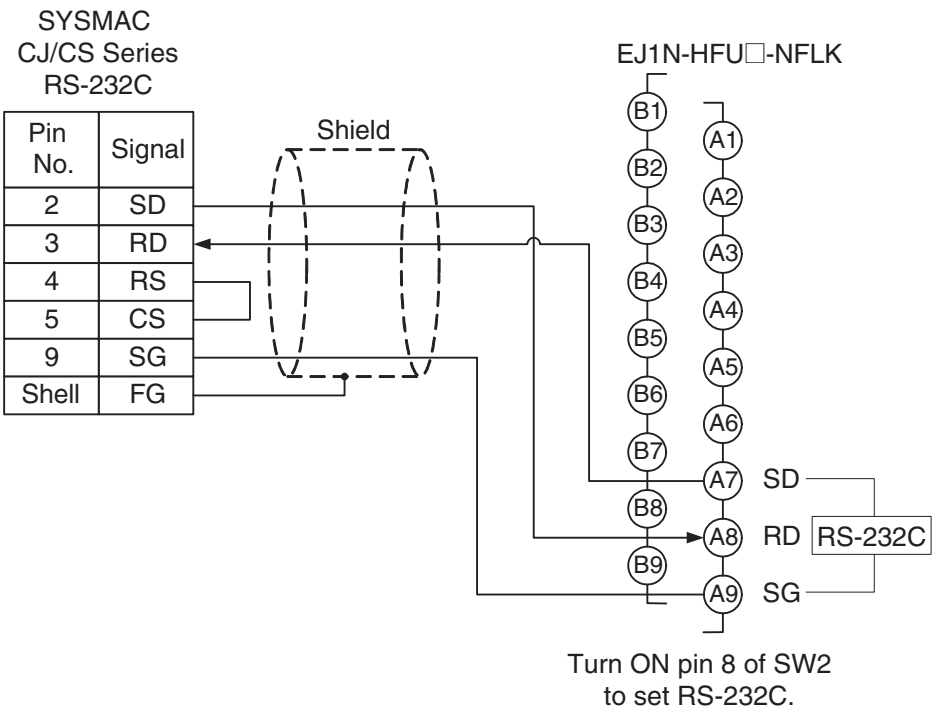
This section describes how to check operation for the configuration shown below.



1,2,3... 1. Connect the EJ1 and PLC.

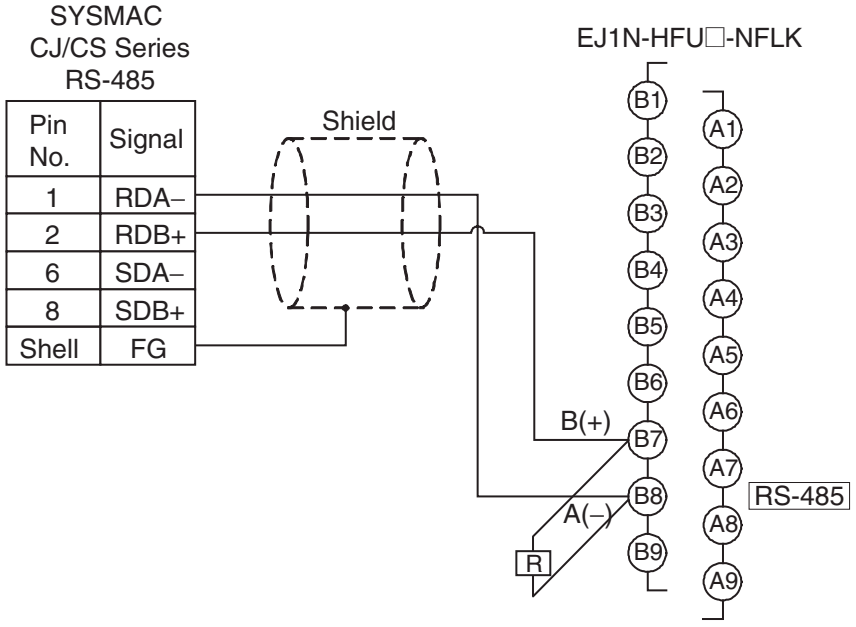
Connect the EJ1N-HFU and Serial Communications Unit as shown in the following diagram.

• RS-232C



Turn ON pin 8 of SW2
to set RS-232C.

• RS-485



• Attach terminating resistance (110 to 125 Ω) to pins 6 and 7 on the EDU port B if there are problems with communications noise resistance.

Note Refer to *Related Manuals* on page xiv for the operating methods for SYSMAC CS/CJ-series CPU Units and Serial Communications Boards/Units.

2. Make the PLC settings.

   Use the CX-Programmer to make the communications port settings for the Serial Communications Unit. The settings can be easily made using IO Table and Unit Setup. Be sure to transfer the settings to the PLC.

DM Area				Bits	Settings		Set value
Board CS Series only		Unit CS/CJ Series					
Port 1	Port 2	Port 1	Port 2				
D32000	D32010	m	m+10	15	Port settings	Setting not required.	0200H
				14 to 12	Reserved	---	
				11 to 08	Serial communications mode	NT Link (1: N)	
				07 to 05	Reserved	---	
				04	Start bits	Setting not required.	
				03	Data length	Setting not required.	
				02	Stop bits	Setting not required.	
				01	Parity	Setting not required.	
				00	Parity	Setting not required.	
D32001	D32011	m+1	m+11	15 to 04	Reserved	---	000AH
				03 to 00	Baud rate	High-speed NT Link	
D32006	D32016	m+6	m+16	15 to 03	Reserved	---	0000H
				02 to 00	Maximum unit number	0	

Note

(1) m = D30000 + 100 × Unit No. (word address)

(2) When using a communications port on the CPU Unit, start the CX-Programmer and set the Host Link port settings in the PLC Settings as follows: Mode: NT Link (1: N), Baud rate: 115,200. Be sure to transfer the settings to the PLC.

(3) The same serial port on the CS/CJ-series Serial Communications Board/Unit cannot be connected to both the EJ1 and an NS-series Programmable Terminal.

The following settings are also required if the models listed below are used.

Model	Terminating resistance ON/OFF switch	2-wire/4-wire switch
CJ1W-SCU41-V1 CJ1W-SCU31-V1 (See note.) CS1W-SCU31-V1 CS1W-SCB41-V1	ON	2

Note The port 2 terminating resistance switch and 2/4-wire switch are on the bottom of the Unit.

3. Set the EJ1 parameters.

   No particular EJ1 parameter settings are required when using SYSMAC CS/CJ-series PLCs. Leave the parameters set to their default settings. When using RS-232C communications, turn ON pin 8 of SW2 to select RS-232C communications.

   For the default settings, the EJ1 monitor and set values are allocated in the DM Area in the PLC as shown in the following table.

If the allocated words shown below are already in use, change the words referring to *Programless Communications Upload/Download Data Area (Variable Type: F0/B0)* on page 134 and to *Programless Communications Upload/Download Start Address (Variable Type: F0/B0)* on page 135.

DM Area	Contents (monitor value)
D00000	Read Response Bits
D00001	Setting Change Response Bits
D00002	Operation Command Response Bits
D00003	Communications Status
D00004	Monitor Value A
D00005	Monitor Value B
⋮	⋮

DM Area	Contents (set value)
D01500	Read Request Bits
D01501	Setting Change Request Bits
D01502	Operation Command Request Bits
D01503	Operation Command Code
D01504	Set Value A
D01505	Set Value B
⋮	⋮

Note When setting programless uploads and downloads, be sure that the words being used in PLC memory are not otherwise used in the program or by other devices.

4. Check operation.

   Turn OFF the power to the EJ1 and PLC and then turn the power back ON. It does not matter which one is turned ON first.
   Refer to the following information and check the operation.

Basic Operations

■ **Monitoring EJ1 Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 process values can be read.

1,2,3... 1. Set the Read Request Bits allocated in PLC memory (D01000) to 0002.
2. Confirm that the Read Response Bits (D00000) are set to 0002.
3. Confirm that D00004 and D00005 are set to the channel 1 and channel 2 process values.
   The EJ1 set value will be continuously read if D01000 is set to 0002. Set D01000 to 0000 to stop reading the set value.

DM Area	Value	Meaning	Procedure step number and confirmation item
D00000	0002	Read Response Bits	Step 2: Set to 0002 by the system.
D00001	0000	Setting Change Response Bits	
D00002	0000	Operation Command Response Bits	
D00003	*000	Communications Status	
D00004	Step 3	Channel 1 Process Value	Step 3: Set to the channel 1 process value by the system.
D00005	Step 3	Channel 2 Process Value	Step 3: Set to channel 2 process value by the system.
D01000	0002	Read Request Bits	Step 1: Set from PLC user program.
D01001	0000	Setting Change Request Bits	

■ **Changing EJ1 Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 set points change.

1,2,3... 1. Set D01504 and D01505 in PLC memory to 0064.
2. Set the Setting Change Request Bits (D01501) to 0001.

3. Confirm that the Setting Change Response Bits (D00001) have been set to 0001.
4. Use the CX-Thermo Support Software to confirm that the EJ1 channel 1 and channel 2 set points have changed to 100. To check operation again, set D01501 to 0000 and once D00001 has changed to 0000 repeat the procedure from step 1.

DM Area	Value	Meaning	Procedure step number and confirmation item
D00000	0000	Read Response Bits	
D00001	0001	Setting Change Response Bits	Step 3: Set to 0001 by the system.
D01500	0000	Read Request Bits	
D01501	0001	Setting Change Request Bits	Step 2: Set from PLC user program.
D01502	0000	Operation Command Request Bits	
D01503	0000	Operation Command Code	
D01504	0064	Channel 1 Set Point	Step 1: Set from PLC user program.
D01505	0064	Channel 2 Set Point	Step 1: Set from PLC user program.

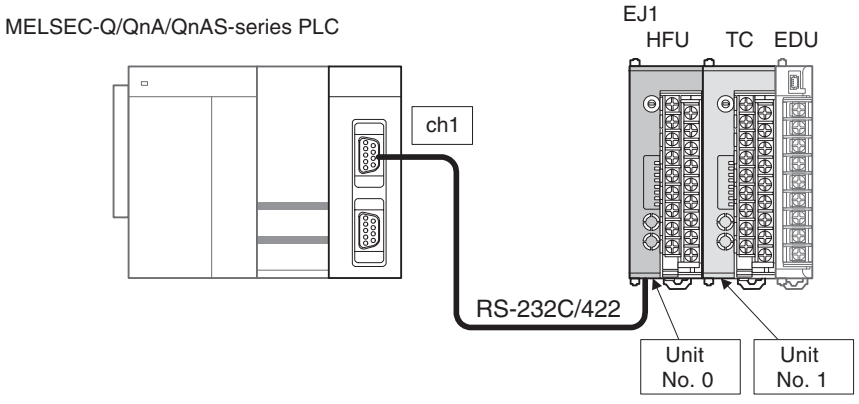
■ **If Not Operating Correctly**

Check the following items if the operation is incorrect.

- Are the wiring and settings correct?
- Was the power cycled once the EJ1 and PLC settings were completed? (The EJ1 settings are enabled only after the EJ1 is reset.)

Checking Operation with the MELSEC-Q/ QnA/QnAS Series

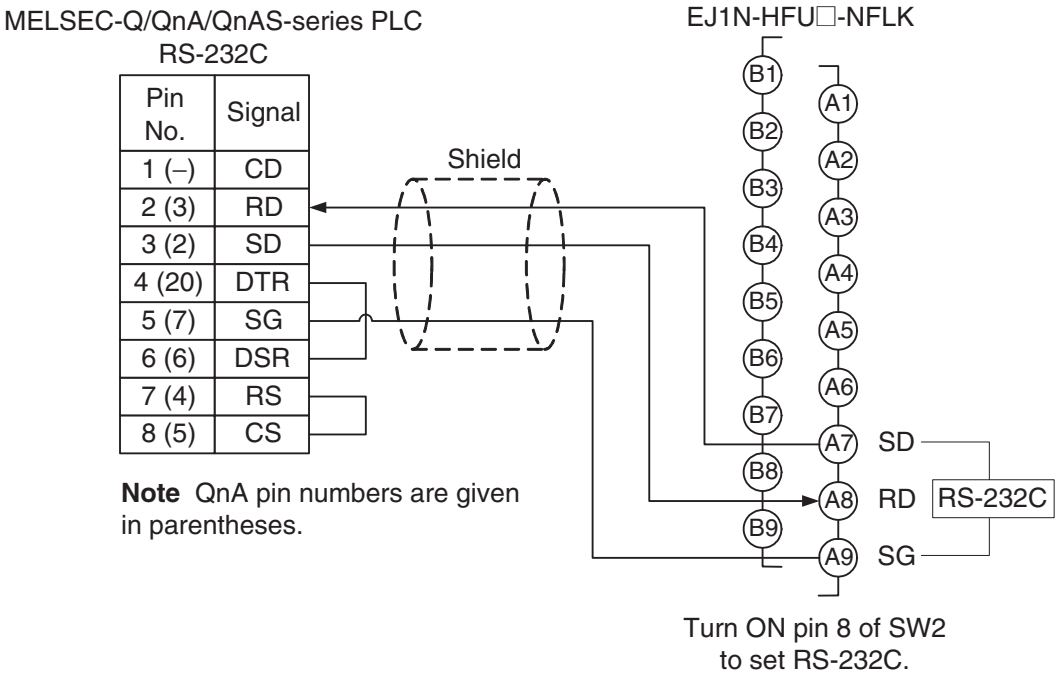
This section describes how to check operation for the configuration shown below.



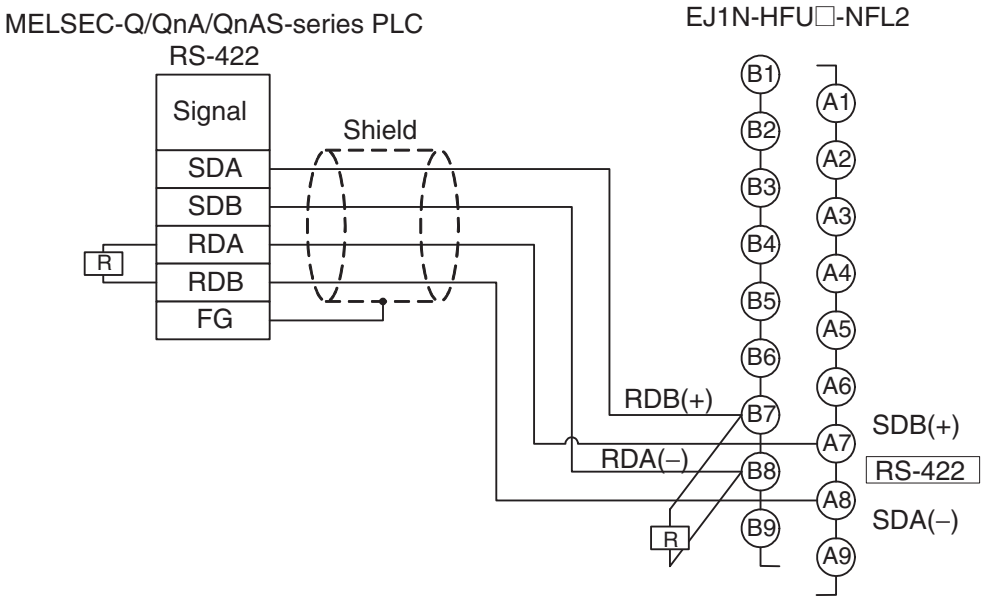
1,2,3... 1. Connect the EJ1 and PLC.

Connect the EJ1N-HFU and Serial Communications Unit as shown in the following diagram.

• RS-232C



• RS-422



- Attach terminating resistance (110 to 125 Ω) to pins 6 and 7 on the EDU port B if there are problems with communications noise resistance.
- Refer to the user's manual if using a Communications Module for the QnA/QnAS Series.

2. Make the PLC settings.

   Use the GX Developer to make the communications settings.

   Start the GX Developer, double-click **PLC Parameter** under *Parameter* in the project tree, click the **I/O Assignment Setting** Tab, click the **Switch Setting** Button on the I/O Assignment Setting Tab Page, and then set the communications port of the Serial Communications Unit as outlined below.

Channel	Switch number.	Bit		Description			Set value
		Position	Setting				
CH1	SW01	b0	OFF	Transmission setting	Operation setting	Independent	0BEEH
		b1	ON		Data bits	8	
		b2	ON		Parity bit	Yes	
		b3	ON		Even/odd parity	Even	
		b4	OFF		Stop bits	1	
		b5	ON		Checksum	Yes	
		b6	ON		Write during RUN	Allowed	
		b7	ON		Setting modifications	Allowed	
		b8 to b15	---		Communications rate setting	115200 bps (0BH)	
	SW02	---		Communications protocol setting		MC protocol format 5	0005H
CH2	SW03	Same settings as SW01.					
	SW04	Same settings as SW02.					
Common for both CH1 and CH2	SW05	---		Station number setting		0	0000H

Note

(1) To set a different baud rate from that given above, refer to *Baud Rate Setting* on page 138 and change 0B.

(2) Refer to *MELSEC-QnA/QnAS Series* on page 138 if using a Communications Module for the QnA/QnAS Series.

3. Make the EJ1 settings.

   When using RS-232C, turn ON pin 8 on SW 2 (to select RS-232C) and make the settings shown in the following table. No other settings are required.

Variable type	Parameter name	Setting/Monitor values
F0/B0	Programless Communications Protocol (Common)	5: MC protocol (format 5)
	Port C Send Wait Time (Common)	1: 1 ms

For the default settings, data registers in the PLC are allocated to the EJ1 monitor and set values as shown in the following table. If the allocated words shown below are already in use, change the words referring to *Programless Communications Upload/Download Data Area (Variable Type: F0/B0)* on page 134 and to *Programless Communications Upload/Download Start Address (Variable Type: F0/B0)* on page 135.

Data register	Contents (monitor value)
D0	Read Response Bits
D1	Setting Change Response Bits
D2	Operation Command Response Bits
D3	Communications Status
D4	Monitor Value A

Data register	Contents (set value)
D1500	Read Request Bits
D1501	Setting Change Request Bits
D1502	Operation Command Request Bits
D1503	Operation Command Code
D1504	Set Value A

Data register	Contents (monitor value)
D5	Monitor Value B
⋮	⋮

Data register	Contents (set value)
D1505	Set Value B
⋮	⋮

4. Check operation.

   Turn OFF the power to the EJ1 and PLC and then turn the power back ON. It does not matter which one is turned ON first. Refer to the following information and check the operation.

Basic Operations

■ **Monitoring EJ1 Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 process values can be read.

1,2,3...

1. Set the Read Request Bits allocated in PLC memory (D1500) to 2.
2. Confirm that the Read Response Bits (D0) are set to 2.
3. Confirm that D4 and D5 are set to the channel 1 and channel 2 process values.
   The EJ1 set value will be continuously read if D1500 is set to 2. Set D1500 to 0 to stop reading the set value.

Data register	Value	Meaning	Procedure step number and confirmation item
D0	2	Read Response Bits	Step 2: Set to 2 by the system.
D1	0	Setting Change Response Bits	
D2	0	Operation Command Response Bits	
D3	*	Communications Status	
D4	Step 3	Channel 1 Process Value	Step 3: Set to channel 1 process value by the system.
D5	Step 3	Channel 2 Process Value	Step 3: Set to channel 2 process value by the system.
D1500	2	Read Request Bits	Step 1: Set from PLC user program.
D1501	0	Setting Change Request Bits	

■ **Changing EJ1 Set Values**

Use the following procedure to confirm that the channel 1 and channel 2 set points change.

1,2,3...

1. Set D1504 and D1505 in PLC memory to 100.
2. Set the Setting Change Request Bits (D1501) to 1.
3. Set the Setting Change Response Bits (D1) to 1.
4. Use the CX-Thermo Support Software to confirm that the EJ1 channel 1 and channel 2 set points have changed to 100. To check operation again, set D1501 to 0 and once D1 has changed to 0 repeat the procedure from step 1.

Data register	Value	Meaning	Procedure step number and confirmation item
D0	0	Read Response Bits	
D1	1	Setting Change Response Bits	Step 3: Set to 1.
D1500	0	Read Request Bits	
D1501	1	Setting Change Request Bits	Step 2: Set from PLC user program.
D1502	0	Operation Command Request Bits	

Data register	Value	Meaning	Procedure step number and confirmation item
D1503	0	Operation Command Code	
D1504	100	Channel 1 Set Point	Step 1: Set from PLC user program.
D1505	100	Channel 2 Set Point	Step 1: Set from PLC user program.

■ **If Not Operating Correctly**

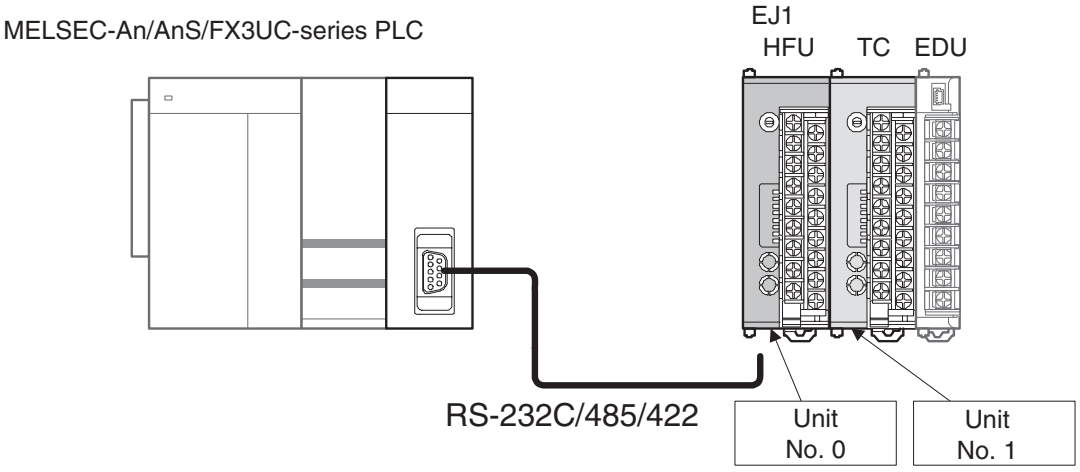
Check the following items if the operation is incorrect.

- Are the wiring and settings correct?
- Was the power turned OFF once the EJ1 and PLC settings had been completed? (The EJ1 settings are enabled only after the EJ1 is reset.)
- The Programless Communications Receive Wait Time may be too short. Refer to *Adjusting Communications Time with PLC* on page 136 and change to a longer wait time.

Checking Operation with the MELSEC-An/AnS/FX3UC Series

V1.1

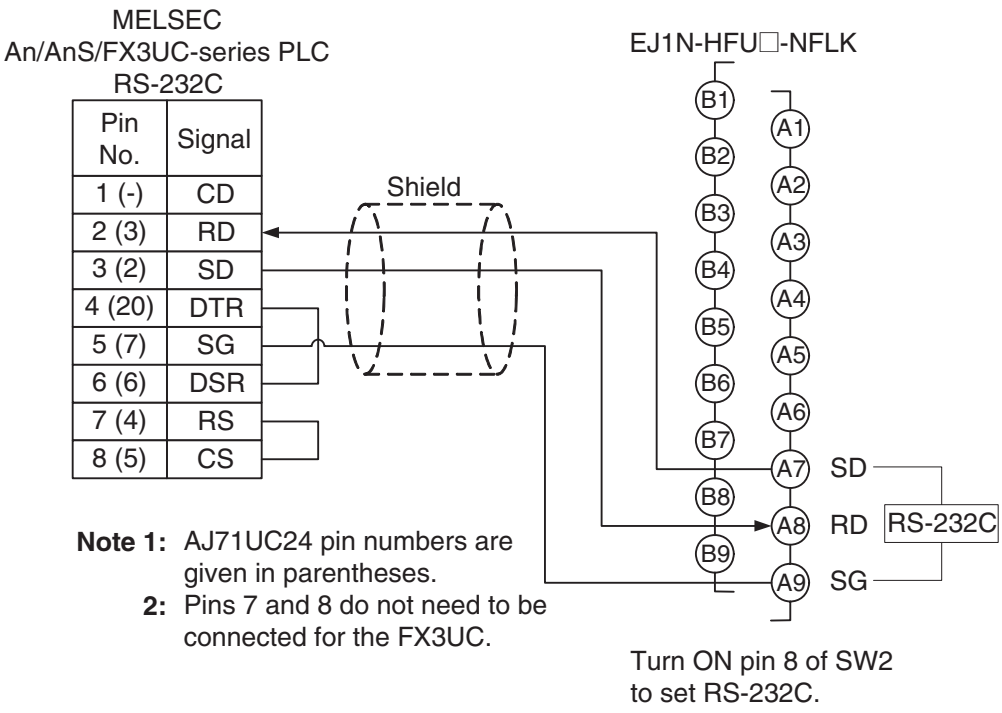
This section describes how to check operation for the configuration shown below.



1,2,3... 1. Connect the EJ1 and PLC.

Connect the EJ1N-HFU and Computer Link Unit as shown in the following diagram.

• RS-232C

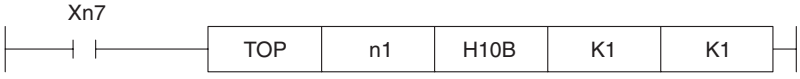


Note 1: AJ71UC24 pin numbers are given in parentheses.

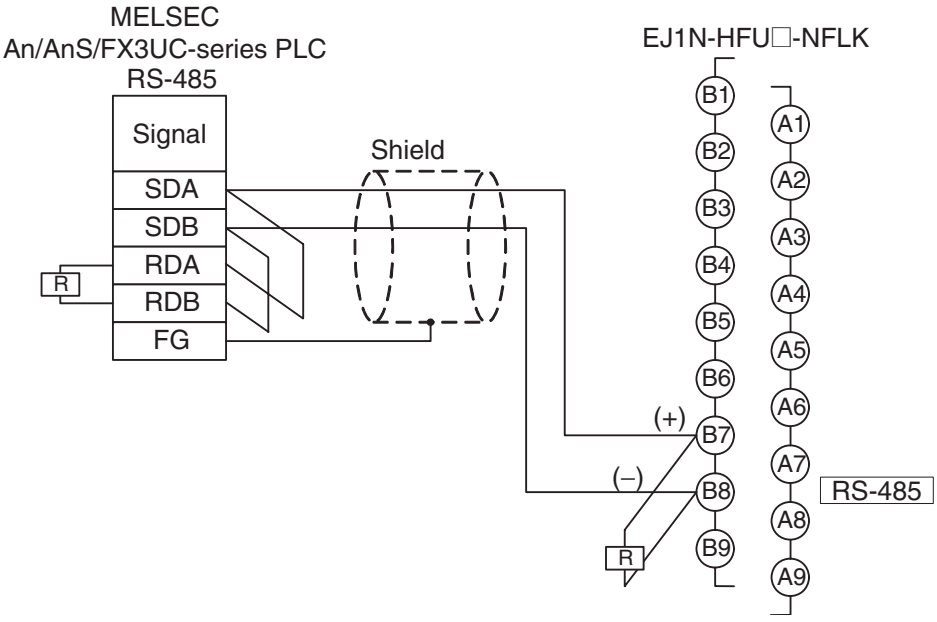
2: Pins 7 and 8 do not need to be connected for the FX3UC.

• When using an An/AnS PLC, disable checking the RS-232C CD terminal at buffer memory address 10BH.

Setting Example



• RS-485



• If noise immunity is a problem in communications, connect terminating resistance of 110 to 125 Ω to pins 6 and 7 of port B on the EDU.

2. Make the PLC settings.

When using an An/AnS-series PLC, use the switches on the front of the Computer Link Unit to make the settings shown in the following table.

Switch		Setting
Station setting		00
Mode setting		Special protocol format 4
Transfer specifications	Data bits	8 bits
	Parity bit	Yes
	Even/odd parity	Even
	Stop bits	1 bit
	Checksum	Yes
	Write during RUN	Allowed
	Computer link/multidrop link (See note 1.)	Computer link
	Communications rate	19.2 kbps

Note (1) This setting is not used on the A1SJ71UC24-R2 or A1SJ71UC24-PRF.

(2) If any other settings are used, change the setting for the EJ1 to the same settings.

(3) Refer to the user's manual for the PLC for setting methods.

If using an FX3UC-series PLC, use the GX Developer to make the communications settings.

Start the GX Developer, double-click **PLC Parameter** under *Parameter* in the project tree, click the **PLC System Setting (2)** Tab, select the channel to use, select the option to set communications, and then make the following settings.

Item	Setting
Protocol	Special protocol communications
Data length	8 bits
Parity	Even
Stop bits	1 bit
Communications rate	19,200 bps
H/W type	When using RS-232C: Normal/RS-232C When using RS-485: RS-485
Checksum	Yes (select the option)
Transmission control procedure	Format 4 (Use CR, LF)
Station	00H
Timeout time	1 (default)

Note (1) If any other settings are used, change the setting for the EJ1 to the same settings.

(2) Refer to the user's manual for the PLC for setting methods.

3. Make the EJ1 settings.

Make the following settings. When using RS-232C, turn ON pin 8 on SW 2 (to select RS-232C). No other settings are required.

Variable type	Parameter name	Setting/Monitor values
F0/B0	Programless Communications Protocol (Common)	4: AnA/AnU CPU Common Commands
	Port C Send Wait Time (Common)	1: 1 ms
	Port C Baud Rate (Common)	4: 19.2 kbps

For the default settings, data registers in the PLC are allocated to the EJ1 monitor and set values as shown in the following table. If the allocated words shown below are already in use, change the words referring to *Programless Communications Upload/Download Data Area (Variable Type: F0/B0)* on page 134 and to *Programless Communications Upload/Download Start Address (Variable Type: F0/B0)* on page 135.

DM Area	Contents (monitor value)
D00000	Read Response Bits
D00001	Setting Change Response Bits
D00002	Operation Command Response Bits
D00003	Communications Status
D00004	Monitor Value A
D00005	Monitor Value B
⋮	⋮

DM Area	Contents (set value)
D01500	Read Request Bits
D01501	Setting Change Request Bits
D01502	Operation Command Request Bits
D01503	Operation Command Code
D01504	Set Value A
D01505	Set Value B
⋮	⋮

4. Check operation.

Turn OFF the power to the EJ1 and PLC and then turn the power back ON. It does not matter which one is turned ON first. Refer to the *Basic Operations* on page 126 and check the operation.

5-1-3 Detailed Settings

Link Data Settings

Link data settings are made to set which EJ1 values to monitor or change.

- Monitor

  The parameters to be monitored are set under Programless Upload Settings.

  The HFU collects monitor values based on these settings for the Units connected to the HFU and transfers the values to PLC memory.

		Variable type
		D7/97
	Address	Programless Upload Setting
4	0000	Reserved (Read Response Bits)
	0001	Reserved (Setting Change Response Bits)
	0002	Reserved (Operation Command Response Bits)
	0003	Reserved (Communications Status)
300 (See note 1.)	0004	Parameter A to be monitored
	0005	Parameter B to be monitored
	⋮	
	012F (See note 2.)	

Note

(1) The limit is 600 parameters for version **V1.1**.
The limit is 1200 parameters for version **V1.2**.

(2) The final address is 025B for version **V1.1**.
The final address is 04B3 for version **V1.2**.

- Changing Settings

  The parameters to be changed are set under the Programless Download Settings.

  The HFU reads the values in a PLC memory area according to these settings and then refreshes the settings for Units connected to the HFU.

		Variable type
		D8/98
	Address	Programless Download Setting
4	0000	Reserved (Read Request Bits)
	0001	Reserved (Setting Change Request Bits)
	0002	Reserved (Operation Command Request Bits)
	0003	Reserved (Operation Command Code)
300	0004	Parameter A to be changed
	0005	Parameter B to be changed
	⋮	
	012F (See note 2.)	

Note

(1) The limit is 600 parameters for version **V1.1**.
The limit is 1200 parameters for version **V1.2**.

(2) The final address is 025B for version **V1.1**.
The final address is 04B3 for version **V1.2**.

■ **Programless Upload/Download Settings**

- Use the CX-Thermo Support Software to make the settings.

- The following parameters can be set. Up to 300 settings can be made for version V1.0, up to 600 settings can be made for version **V1.1**, and up to 1,200 settings can be made for version **V1.2**.

TC2/4

Programless upload settings	Variable types: C4/84, C5/85, D4/94, D5/95, D6/96, and C9/89 (however, G3ZA1 to G3ZA4) **V1.2**
Programless download settings	Variable types: D4/94, D5/95, and D6/96

Note HFU parameters other than those listed in the following table cannot be used when making programless upload/download settings. If parameters that do not appear in the table are used, internal communication errors will occur, and programless communications will be delayed.

HFU

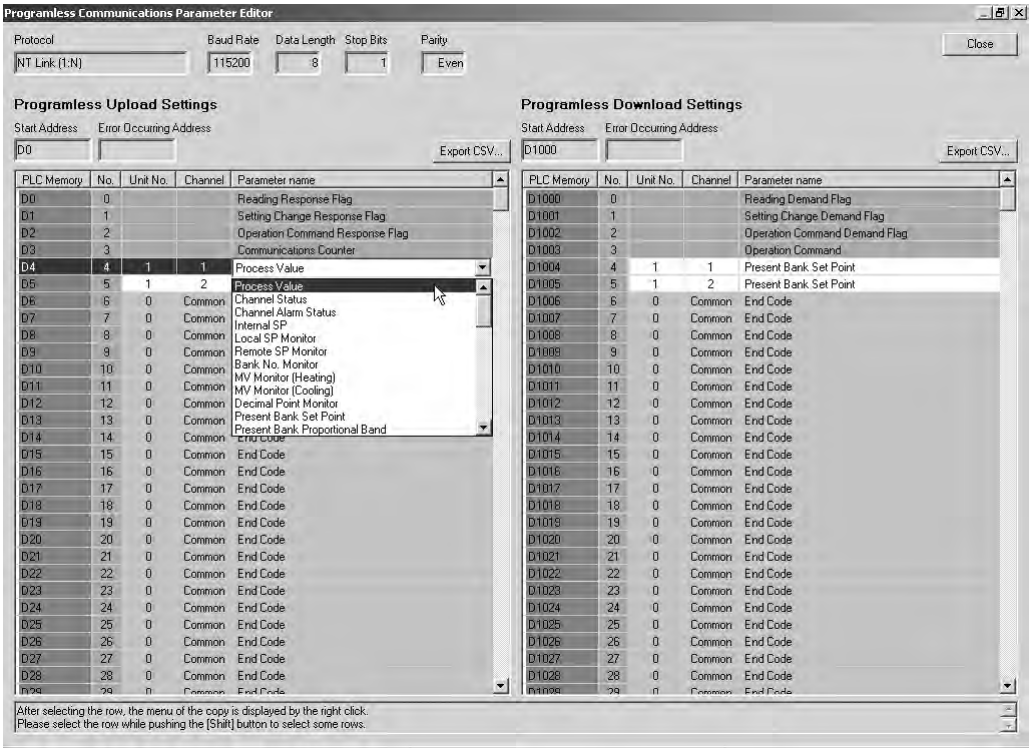
Programless upload settings	Error status: Refer to the *Error Status* section on page 133.
Programless download settings	Bit-specified operation commands. Refer to page 154 for details. **V1.2**

- Parameters can be set to *Not used* to reserve words for future use.

  Note The words set to *Not used* cannot be used for any other purpose except the programless function.

- Only channels 1 and 2 can be set for TC2 Units.
- Unit numbers can be between 0 and 31, but one HFU can manage only up to 16 Basic Units.

CX-Thermo Programless Upload Settings: Setting Screen



⚠ Caution

- There are 304 programless upload and 304 programless download settings (604 each for version V1.1 and 1,204 each for version V1.2), which are linked to data to the PLC memory, from the start address to the end code (00FF). Always set an end code at the end of linked data, because all 304 pieces of data will be linked if there is no end code (604 for version V1.1 and 1,204 for version V1.2).
  Each start area contains a reserved area used to control programless communications from the PLC. Information on how to use programless uploading and downloading is provided under *5-1-4 Description of Operation*.
- The communications speed will drop if there is a lot of linked data. Adjust the number of linked data items that are set to suit the system.
- If non-existent settings are set, programless uploading and downloading will not operate correctly. The communications speed may also be affected, so always use valid settings.

■ **Error Status**

The Error Status is used for detection of Basic Unit internal communications errors.

	(Leftmost bit)						Unit No.									(Rightmost bit)
Error Status 1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Status 2	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

If an error occurs in communications with a Basic Unit, the bit that corresponds to the unit number of the Basic Unit will turn ON. The bit will turn OFF when normal communications are recovered.

■ **Examples:**

Bit 15 Turns ON.

This indicates that a communications error has occurred for Unit No. 15.

Communications Protocols and Memory Allocation

For the EJ1 to communicate with the PLC, the Programless Communications Protocol must be set and the area in PLC memory that will be allocated to parameters for the Programless Upload/Download Settings must be set.

- The communications protocol is set under Programless Communications Protocol.
- Select the type of memory area under Programless Communications Upload/Download Data Area and set the start address for the memory allocation in the Programless Communications Upload/Download Start Address.

■ **Programless Communications Protocol (Variable Type: F0/B0)**

Used to set the programless communications protocol.

Variable type	Parameter name	Setting/Monitor values	Default
F0/B0	Programless Communications Protocol (Common)	0: Not used. 1: Not used. 2: NT Link (1: N) Connectable PLCs: SYSMAC CS/CJ Series 3: Not used. 4: AnA/AnU CPU Common Commands Connectable PLCs: MELSEC-An/AnS/ FX3UC Series 5: MC protocol (format 5) Connectable PLCs: MELSEC-Q/QnAS Series	2

Conditions for use	No special conditions

Note Reset the EJ1 to enable settings.

■ **Programless Communications Upload/Download Data Area (Variable Type: F0/B0)**

Used to set the area in PLC memory that will be allocated to the parameters set with the Programless Upload/Download Settings. Set this parameter according to the Programless Communications Protocol.

- SYSMAC CS/CJ Series PLCs

Set value	Area	Applicable areas by CPU Unit				
		CJ1H-CPU67H	CJ1H-CPU66H	CJ1H-CPU65H CJ1G-CPU45H	CJ1G-CPU44H -CPU43H -CPU42H	CJ1M
0 (default)	DM	Applicable	Applicable	Applicable	Applicable	Applicable
1	EM0	Applicable	Applicable	Applicable	Applicable	---
2	EM1	Applicable	Applicable	Applicable	---	---
3	EM2	Applicable	Applicable	Applicable	---	---
4	EM3	Applicable	Applicable	---	---	---
5	EM4	Applicable	Applicable	---	---	---
6	EM5	Applicable	Applicable	---	---	---
7	EM6	Applicable	Applicable	---	---	---
8	EM7	Applicable	---	---	---	---
9	EM8	Applicable	---	---	---	---
10	EM9	Applicable	---	---	---	---
11	EMA	Applicable	---	---	---	---
12	EMB	Applicable	---	---	---	---
13	EMC	Applicable	---	---	---	---

Set value	Area	Applicable areas by CPU Unit		
		CJ2H -CPU68-EIP -CPU67-EIP	CJ2H -CPU66-EIP	CJ2H -CPU65-EIP -CPU64-EIP
0 (default)	DM	Applicable	Applicable	Applicable
1	EM0	Applicable	Applicable	Applicable

Set value	Area	Applicable areas by CPU Unit		
		CJ2H -CPU68-EIP -CPU67-EIP	CJ2H -CPU66-EIP	CJ2H -CPU65-EIP -CPU64-EIP
2	EM1	Applicable	Applicable	Applicable
3	EM2	Applicable	Applicable	Applicable
4	EM3	Applicable	Applicable	Applicable
5	EM4	Applicable	Applicable	---
6	EM5	Applicable	Applicable	---
7	EM6	Applicable	Applicable	---
8	EM7	Applicable	Applicable	---
9	EM8	Applicable	Applicable	---
10	EM9	Applicable	Applicable	---
11	EMA	Applicable	---	---
12	EMB	Applicable	---	---
13	EMC	Applicable	---	---

- MELSEC PLCs

Set value	Area
0 (default)	Data registers (D)
1	Link registers (W) **Note** Not supported by the FX3UC.
2	File registers (R) **Note** Expansion registers (R) for the FX3UC.

Note (1) Make the programless upload settings in the Programless Communications Upload Data Area and the programless download settings in the Programless Download Data Area.

(2) Reset the EJ1 to enable settings.

■ **Programless Communications Upload/Download Start Address (Variable Type: F0/B0)**

Used to set the start address in the memory area set as the Programless Communications Upload/Download Data Area for the parameters set as the Programless Upload/Download Settings.

- The parameters will occupy the amount of PLC memory set in the Programless Upload/Download Settings from the address set as the Programless Communications Upload/Download Start Address.
- Refer to the following table and set a start address within the accessible range.

Programless Communications Protocol	PLC area	Setting range	Default	
			Programless Communications Upload Start Address	Programless Communications Download Start Address
NT Link (1: N)	DM	0000 to 32767	0	500 (1,000 for version V1.1; 1,500 for version V1.2)
	EM			
MC protocol (format 5) AnA/AnU CPU Common Commands	Data registers	0000 to 12287		
	Link registers	0000 to 1FFF		
	File registers	0000 to 32767		

Note

(1) Make sure the same address is not allocated in both the Programless Upload Settings and Programless Download Settings.

(2) Reset the EJ1 to enable settings.

(3) The ranges of registers that can be used are different for the An-series, AnS-series, and FX3UC-series PLCs. Refer to the PLC manual for detailed setting ranges.

Communications Settings

The following parameters are used to make the EJ1 communications settings. Set these parameters to the same conditions as the PLC.

Variable type	Parameter name	Setting/Monitor values	Default
F0/B0	Port C Communications Baud Rate (Common)	3: 9.6 kbps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 115.2 kbps	7
	Port C Communications Data Length (Common)	0: 7 bits 1: 8 bits	1
	Port C Communications Parity (Common)	0: None 1: Even 2: Odd	1
	Port C Communications Stop Bits (Common)	0: 1 bit 1: 2 bits	0
	Port C Send Wait Time (See *Conditions for use*.) (Common)	0 to 99 ms	5

Conditions for use	The Programless Communications Protocol cannot be NT Link (1: N).

Note Reset the EJ1 to enable settings.
When using an NT Link, use the default settings for all the above parameters.

Adjusting Communications Time with PLC

With programless communications, the time from when the command is sent to the PLC until a response is returned is monitored using the Programless Communications Receive Wait Time.

- This time will differ, depending on the PLC cycle time. Consider the PLC system configuration and allow sufficient margin when setting the response wait time. Communications will not be normal if this setting is too short.

Variable type	Parameter name	Setting range	Default
F0/B0	Programless Communications Receive Wait Time (Common)	10 to 10000 ms	2000

Conditions for use	The Programless Communications Protocol cannot be NT Link (1: N).

Note Reset the EJ1 to enable the setting.

Operation for Error in Programless Link

V1.1

Either continuing or stopping operation can be selected for when errors occur in the programless link.

Variable type	Parameter name	Setting range	Default
F0/B0	Selection of Programless Communications Operation during Error (Common)	0: Continue 1: Stop	1

Conditions for use	No special conditions

Note Reset the EJ1 to enable the setting.

Setting range	Operation
0: Continue	Programless communications will be restarted automatically when the cause of the programless link error has been removed and communications are possible with the PLC.
1: Stop	Read/write operations for PLC memory will not be performed even after the cause of the programless link error has been removed and communications are possible with the PLC. Instead, EEEE will be set in the Operation Command Response Bits. Refer to *Method for Canceling Communications Errors* on page 156 for information on clearing the error.

Note When using the default Basic Unit settings, programless communications will stop if a programless link error occurs. This will make reading parameters, changing settings, and executing operation commands impossible. When starting normal operation, it is recommended that the programless communications error operation selection be set to continue operation.

PLC Settings

SYSMAC CS/CJ Series

The settings are the same as made when checking operation. Refer to *Checking Operation with SYSMAC CS/CJ Series PLCs* on page 119.

MELSEC-Q Series

The settings are the same as made when checking operation. Make settings based on the following table if the baud rate or transmission settings need to be changed.

Channel	Switch number	Bit position	Description
CH1	SW01	b0 to 7	Transmission settings
		b8 to 15	Baud rate setting
	SW02	---	Communications protocol setting
CH2	SW03	b0 to 7	Transmission settings
		b8 to 15	Baud rate setting
	SW04	---	Communications protocol setting
Common for both CH1 and CH2	SW05	---	Station number setting

■ **Transmission Settings**

Bit	Description	OFF (0)	ON (1)	Setting	
b0	Operation setting	Independent	Linked	0	E
b1	Data bits (See note.)	7	8	1	
b2	Parity bit (See note.)	No	Yes	1	
b3	Even/odd parity (See note.)	Odd	Even	1	
b4	Stop bits (See note.)	1	2	0	E
b5	Checksum	No	Yes	1	
b6	Write during RUN	Prohibited	Allowed	1	
b7	Setting modifications	Prohibited	Allowed	1	

Note Change the settings if required. If changes are made, make the same settings on the EJ1.

■ **Baud Rate Setting**

Communications baud rate	Setting (b8 to 15)
9.6 (kbps)	05H
19.2 (kbps)	07H
38.4 (kbps)	09H
57.6 (kbps)	0AH
115.2 (kbps) (See note.)	0BH (recommended)

Note If both channel 1 and channel 2 are used on the QJ71C24(-R2), make sure that the total baud rate for both channels is 115.2 kbps or less.

Note Make the same settings on the EJ1.

■ **Communications Protocol Setting**

Communications protocol setting	Programless Communications Protocol	Setting
MC Protocol, Format 5	MC Protocol (format 5)	0005H

Note Make sure this setting is the same as the Programless Communications Protocol parameter.

■ **Station Number Setting**

Set to 0000H to match the EJ1 setting.
If the station number of the Serial Communications Unit is set to any value except 0, set the programless communications node number in the EJ1 to the same value.

MELSEC-QnA/QnAS Series

Make the settings shown in the following table for the channels being used.

Setting switch		Setting
Station number switch		00
Mode switch		Dedicated protocol Binary mode Format 5
Transmission specifications switch	Operation setting	Independent operation
	Data bits	8 bits
	Parity bit enable/disable	Enable
	Even parity/odd parity	Even
	Stop bits	1 bit
	Checksum	Yes
	Write during RUN enable/disable	Enable
	Setting change enable/disable	Enable
	Transmission rate	115.2 kbps (See note.)

Note If both channel 1 and channel 2 are used, make sure that the total baud rate for both channels is 115.2 kbps or less.

Note (a) If settings other than those listed above are made, make the same settings on the EJ1.

(b) Refer to the PLC operation manual for details on setting methods.

MELSEC-An/AnS/FX3UC Series V1.1

The settings are the same when confirming operation. Refer to *Checking Operation with the MELSEC-An/AnS/FX3UC Series* on page 127.

5-1-4 Description of Operation

Set values are read and changed and operation commands are executed by setting a value in a Request Bits allocated in a PLC memory area.

DM Area	Meaning
D00000	Read Response Bits
D00001	Setting Change Response Bits
D00002	Operation Command Response Bits
D01500	Read Request Bits
D01501	Setting Change Request Bits
D01502	Operation Command Request Bits

The Request Bits are set to the following values.

Bits	Value	Action
Read Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Reads the parameters set in the Programless Upload Setting Area once.
	0002: Multi	Continuously reads the parameters set in the Programless Upload Setting Area.
	0003: Read setting	Reads the parameters set in the Programless Download Setting Area and writes them to the upload area.
	0004: Read setting 2 **V1.1**	Reads the parameters set in the Programless Download Setting Area and writes them to the download area.
Setting Change Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Changes all of the parameters set in the Programless Download Setting.
	0002: Multi	The first time, all of the parameters set in the Programless Download Setting are changed. Afterwards, changes are made only to parameters for which values have been changed.
Operation Command Request Bits	0000: Stop operation	Stops operation after a series of operations has been completed.
	0001: Single	Executes the operation command set in the Operation Command Code.
	0002: Multi	The first time, the operation command set in the Operation Command Code is executed. Afterwards, the operation command is executed each time the Operation Command Code changes.
	0003: Single (Bit specification) **V1.2**	Executes the bit specification operation command a single time.
	0004: Multi (Bit specification) **V1.2**	The first time, all bit specification operation commands are executed. Afterwards, operation commands for channels that have been changed are executed.

Note To change the Request Bits, first set the Request Bits to 0000 then change the setting. The same applies when periodically executing the same operation command.

Example: Changing a Single Action to a Multi Action

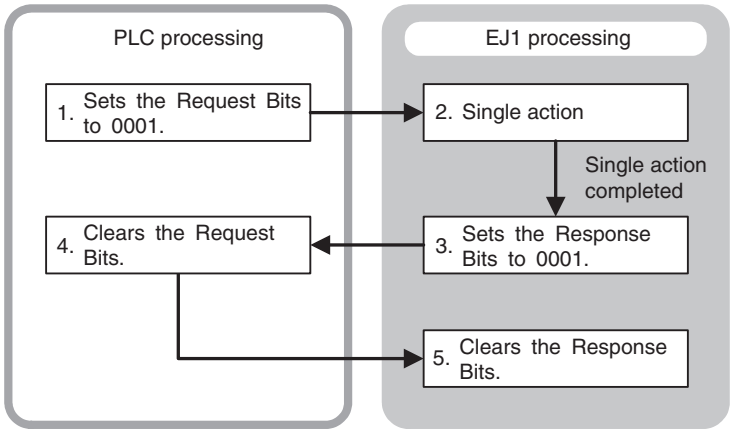
1,2,3... 1. For a single action, the Response Bits are set to the single action value, 0001.

Note The Request Bits cannot be changed directly to 0002 because the setting will not be accepted.

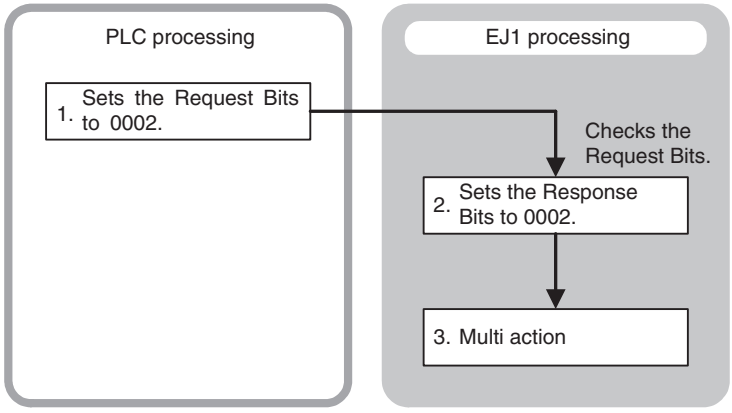
2. Change the Request Bits to 0000, then confirm that the Response Bits have been set to 0000.

3. Then change the Request Bits to the multi action setting of 0002.
   - Each set of Request Bits has a corresponding set of Response Bits. Once the Request Bits have been set, the Response Bits operate in the order shown in the following table.

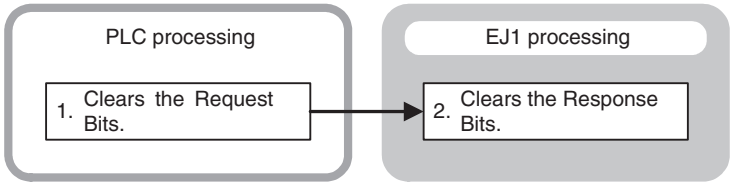
Type	Order of action
Single	1. The PLC sets the Request Bits. 2. The EJ1 performs a single action. 3. The EJ1 sets the Response Bits to the same value as the Request Bits. 4. The PLC clears the Request Bits. 5. The EJ1 clears the Response Bits.


PLC processing
EJ1 processing
1. Sets the Request Bits to 0001.
2. Single action
Single action completed
4. Clears the Request Bits.
3. Sets the Response Bits to 0001.
5. Clears the Response Bits.

Type	Order of action
Multi	1. The PLC sets the Request Bits. 2. The EJ1 sets the Response Bits to the same value as the Request Bits. 3. The EJ1 performs a multi action.


PLC processing
EJ1 processing
1. Sets the Request Bits to 0002.
Checks the Request Bits.
2. Sets the Response Bits to 0002.
3. Multi action

Type	Order of action
Operation stopped	1. The PLC clears the Request Bits. 2. The EJ1 clears the Response Bits.



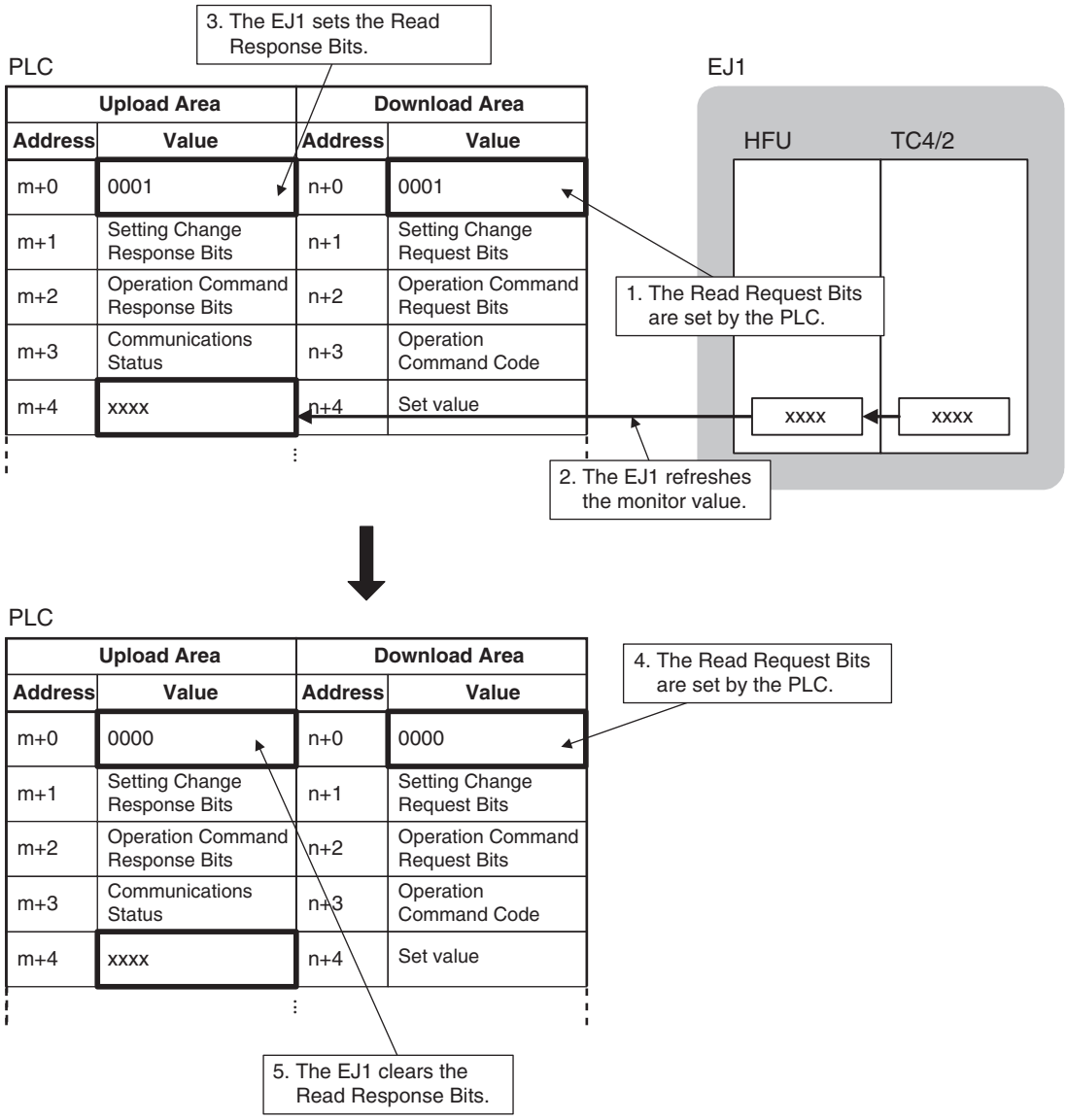
Operation Procedure

Monitor

Once the PLC sets the value of the Read Request Bits, the EJ1 writes the value set under Programless Upload Settings to the PLC memory area.

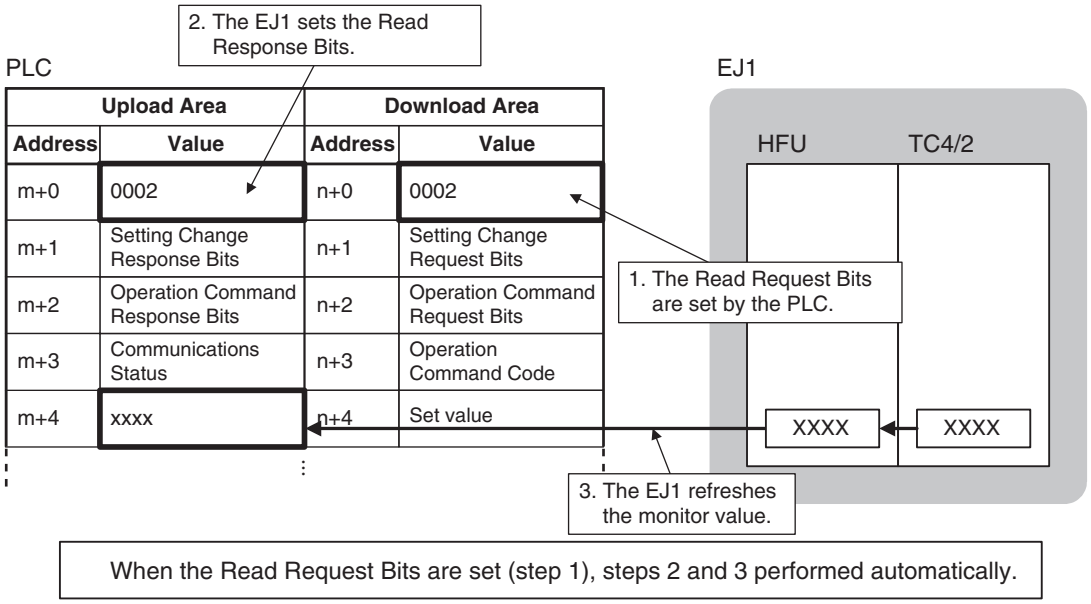
- Single Read

  The parameters set in the Programless Upload Setting are read once.



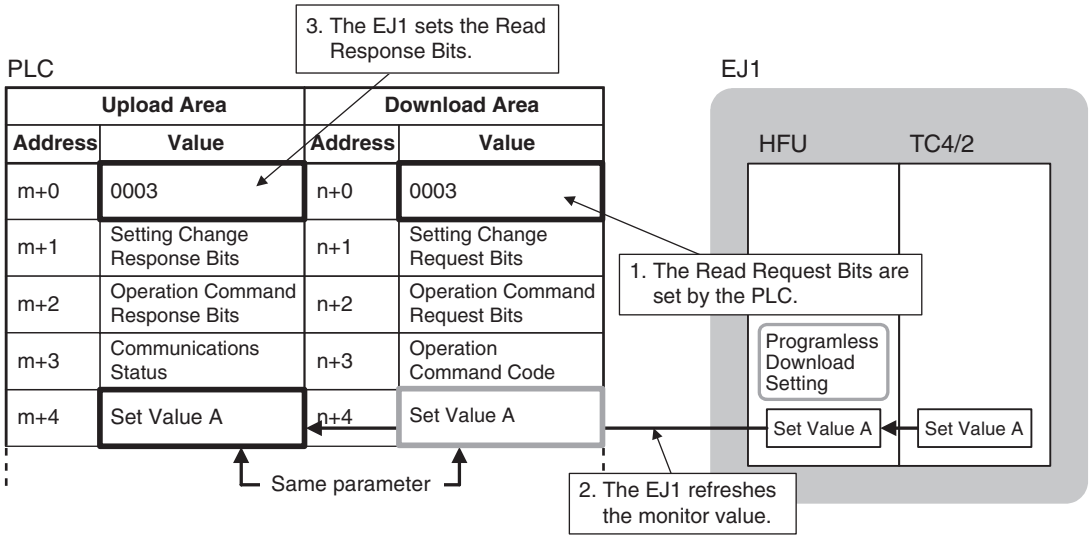
• Multi Read

The parameters set in the Programless Upload Setting are read continuously.



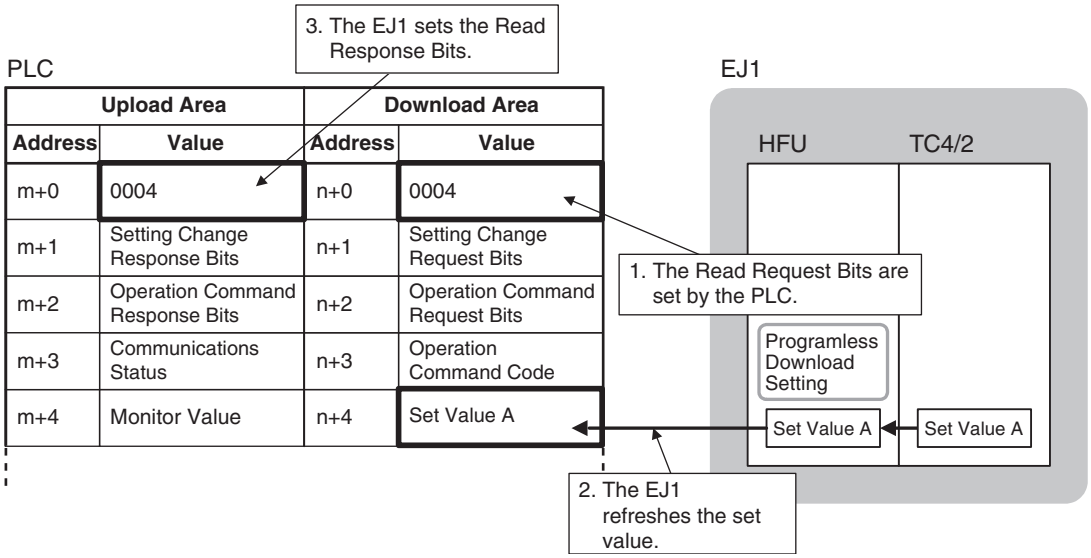
• Read Settings

With the normal monitor operation, the value set under Programless Upload Setting is read to the upload data area in PLC memory. With the Read Setting operation, the value set under Programless Download Setting is read to the upload data area in PLC memory to confirm that the setting is correct.



• Read Settings 2 **V1.1**

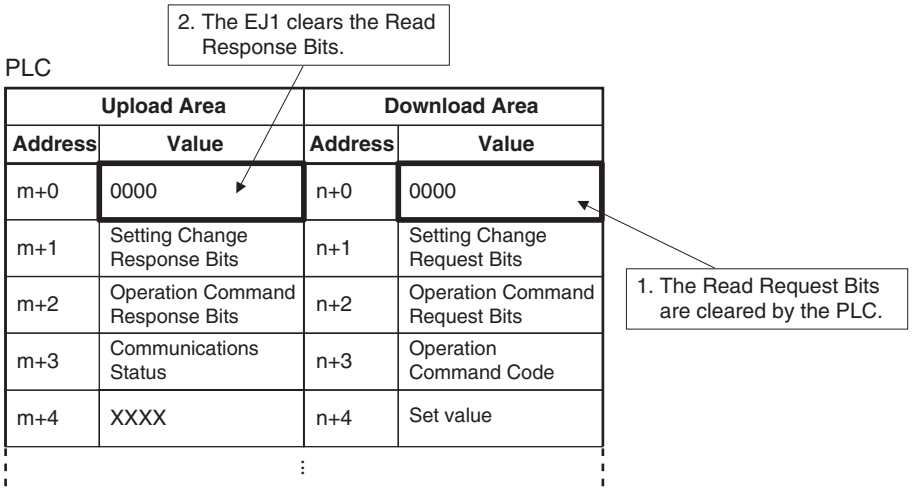
The value set under Programless Download Setting is read to the download data area in PLC memory. This can be used to initialize settings in the PLC memory.



Upload Area		Download Area	
Address	Value	Address	Value
m+0	0004	n+0	0004
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	Monitor Value	n+4	Set Value A

• Stop Operation

Operation is stopped after a series of operations has been completed.



Upload Area		Download Area	
Address	Value	Address	Value
m+0	0000	n+0	0000
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	XXXX	n+4	Set value

■ **Monitor Values**

If the monitor value has a decimal point, keep the decimal point in mind when handling the monitor value.

Example: monitor value 03E8H or 1000 → 100.0

The set value in the EJ1 will not change even if the monitor value is changed.

■ Checking Programless Communications Operation from the PLC

To confirm that programless communications are working from the PLC, confirm that reserved bit 15 of the Communications Status under the Programless Upload Settings is changing. Bit 15 repeatedly turns ON/OFF during communications. Bit 15 alternates between ON and OFF, changing at each programless communications.

Example: Multi Read
Each time all the parameters set under Programless Upload Settings are written to the PLC, bit 15 changes between ON and OFF.

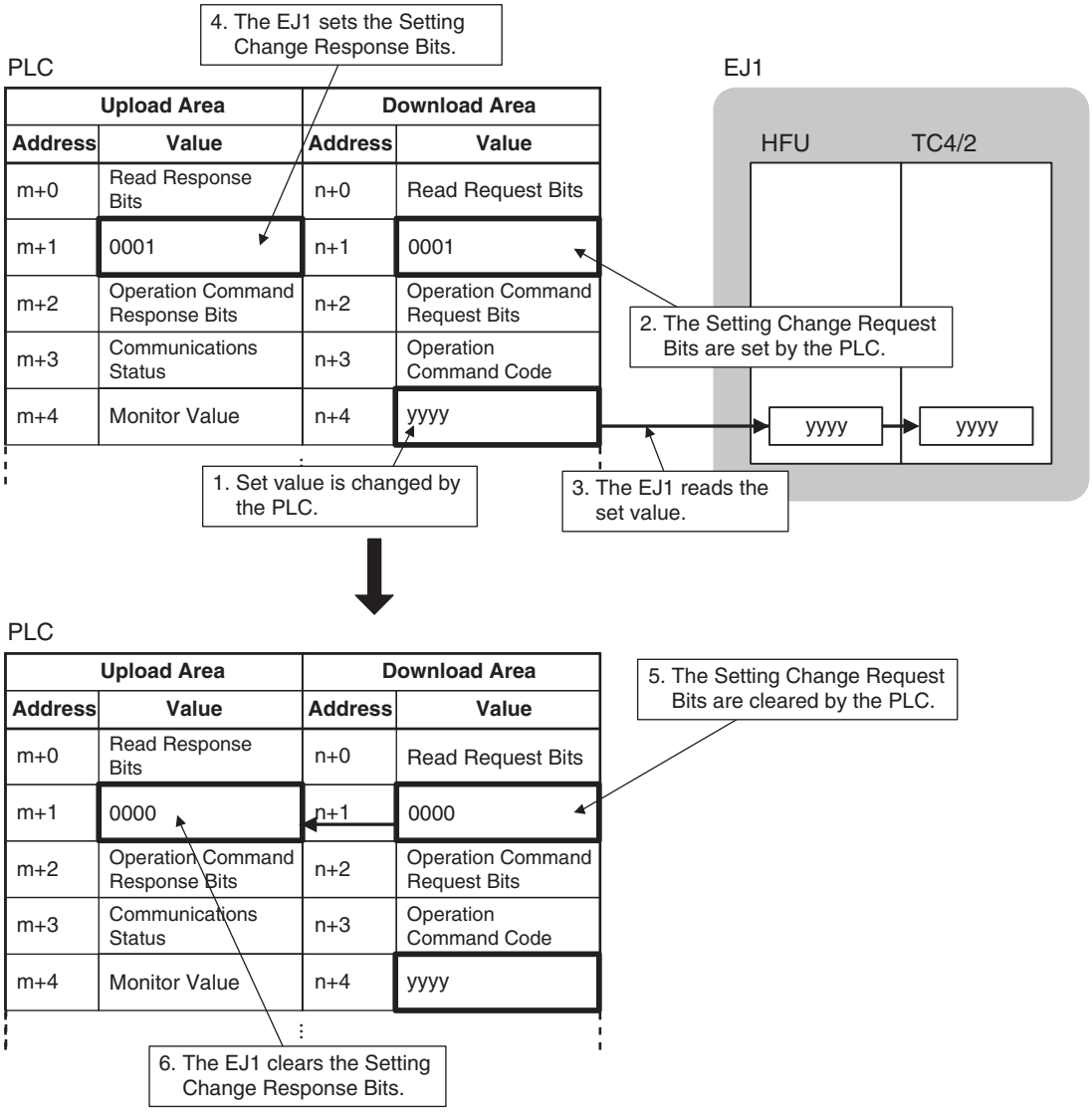
Setting Changes

To change EJ1 settings from the PLC, first change the values in the Download Area in the PLC memory and then set the Setting Change Request Bits.

The EJ1 will then read the Download Area in the PLC memory and change the corresponding settings.

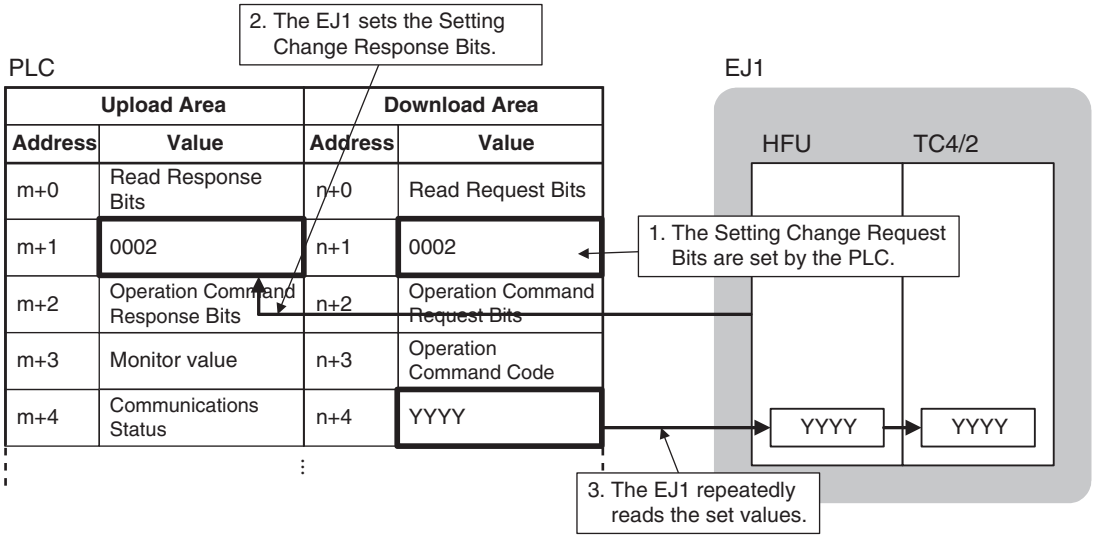
- Single Action

  All of the parameters set in the Download Area are written.



• Multi Action

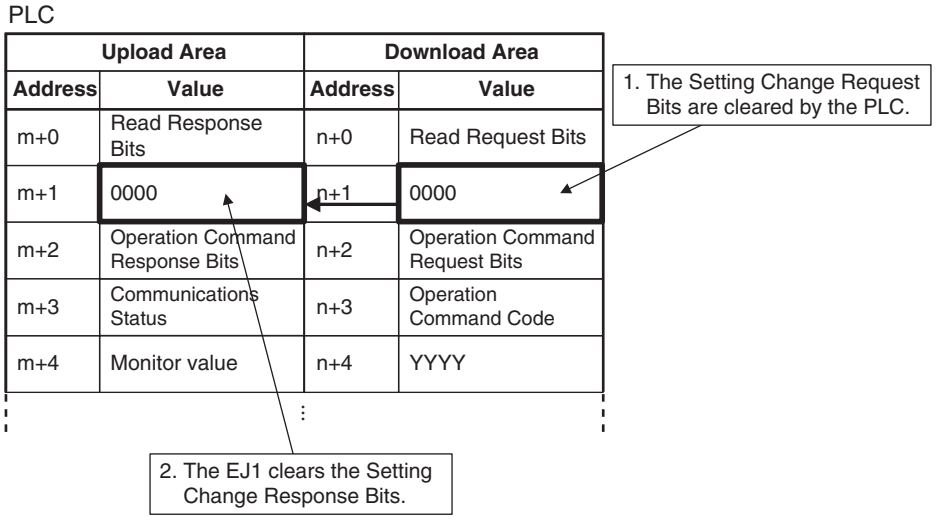
The first time, all of the parameters set in the Download Area Setting are changed. Afterwards, changes are made only to parameters for which values have been changed.



Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	0002	n+1	0002
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Monitor value	n+3	Operation Command Code
m+4	Communications Status	n+4	YYYY

• Stop Operation

Operation is stopped after a series of operations has been completed.



Upload Area		Download Area	
Address	**Value**	**Address**	**Value**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	0000	n+1	0000
m+2	Operation Command Response Bits	n+2	Operation Command Request Bits
m+3	Communications Status	n+3	Operation Command Code
m+4	Monitor value	n+4	YYYY

Note (1) Always set the Setting Change Request Bits last. If the Setting Change Request Bits are set before the set value is changed, an unexpected value will be written.

(2) All programless download parameters will be updated when the Setting Change Request Bits are set. If set values are not the same in EJ1 and PLC memory, e.g., when the power is turned ON or the bank is changed, always change the values in PLC memory first and then set the Setting Change Request Bits.

■ **Set Values**

- If the set value contains a decimal point, omit the decimal point and set the value.

  Example: 100.0 → 1000 or 03E8H: set value

- When changing set values, always set a new value within the setting range. The set value will not be changed if a value outside the range is set.

Operation Commands

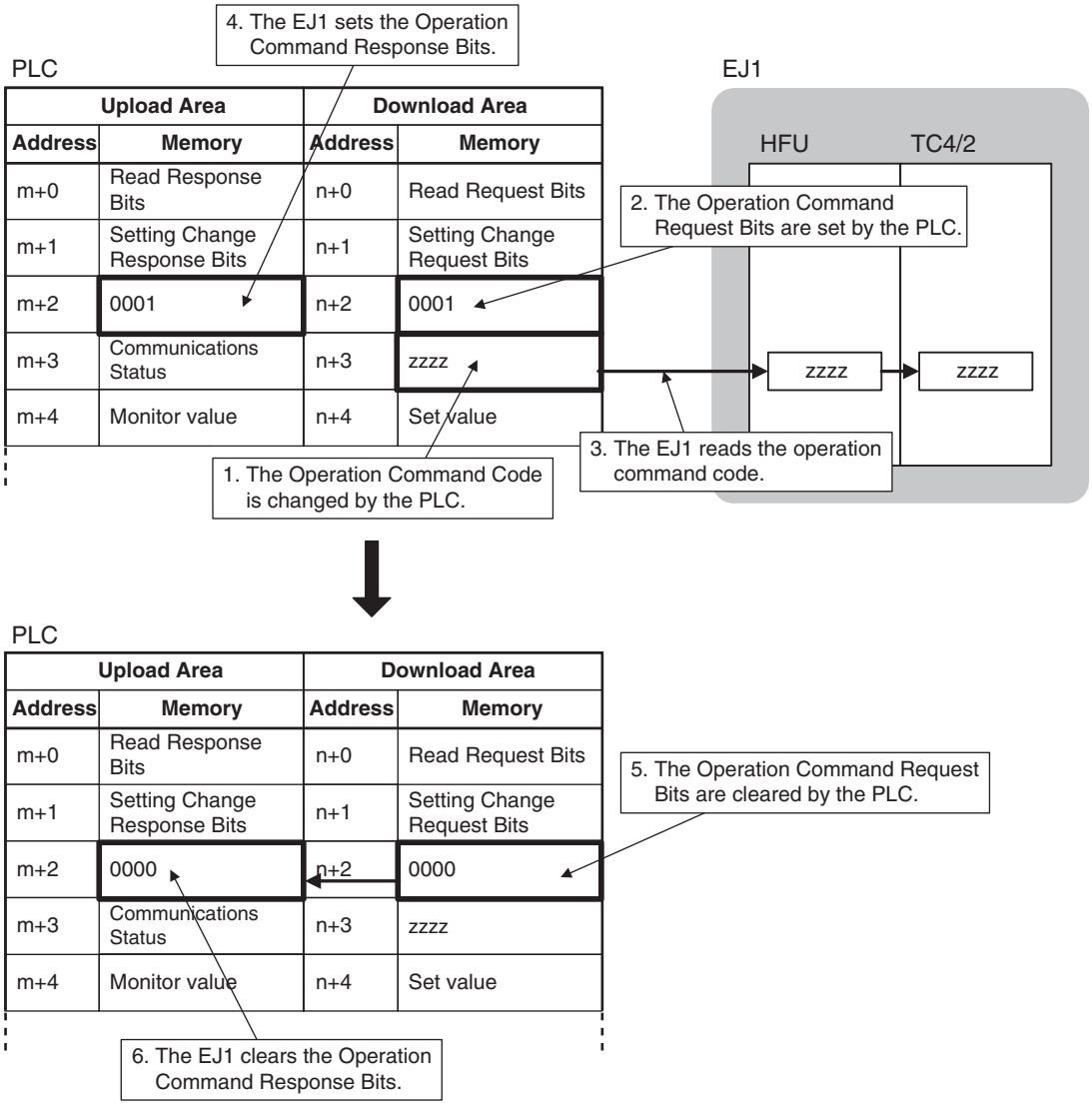
When the EJ1 confirms that the Operation Command Request Bits have been set by the PLC, the EJ1 reads the operation command code set in PLC memory and accepts the operation command.

To execute an operation command, set the operation command code in the PLC memory words corresponding to the Programless Download Settings and then set the Operation Command Request Bits.

Note Refer to *5-1-5 Operation Command Codes for Programless Communications* for information on operation command codes.

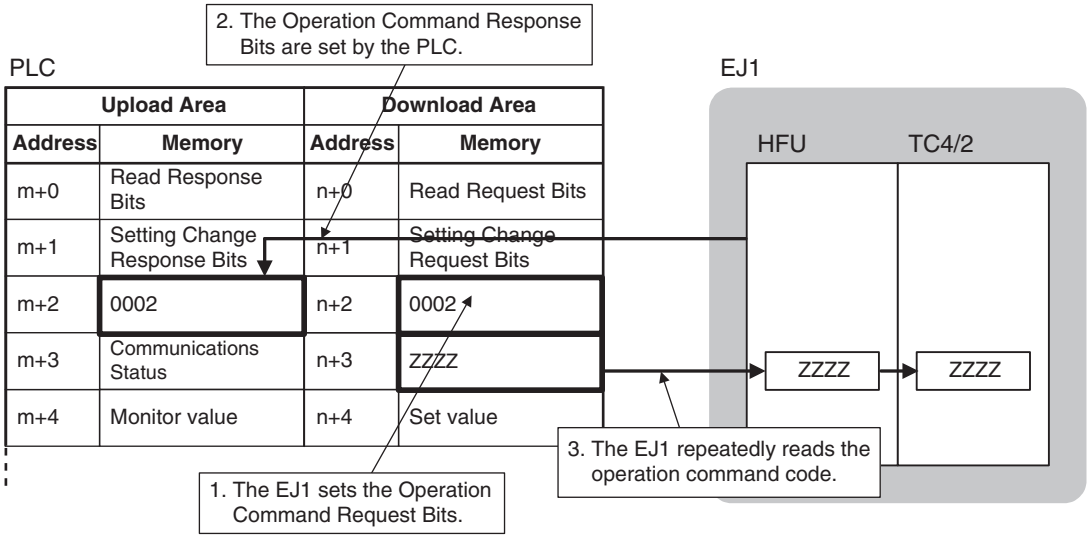
- Single Operation Command

  Operation commands are accepted only once.



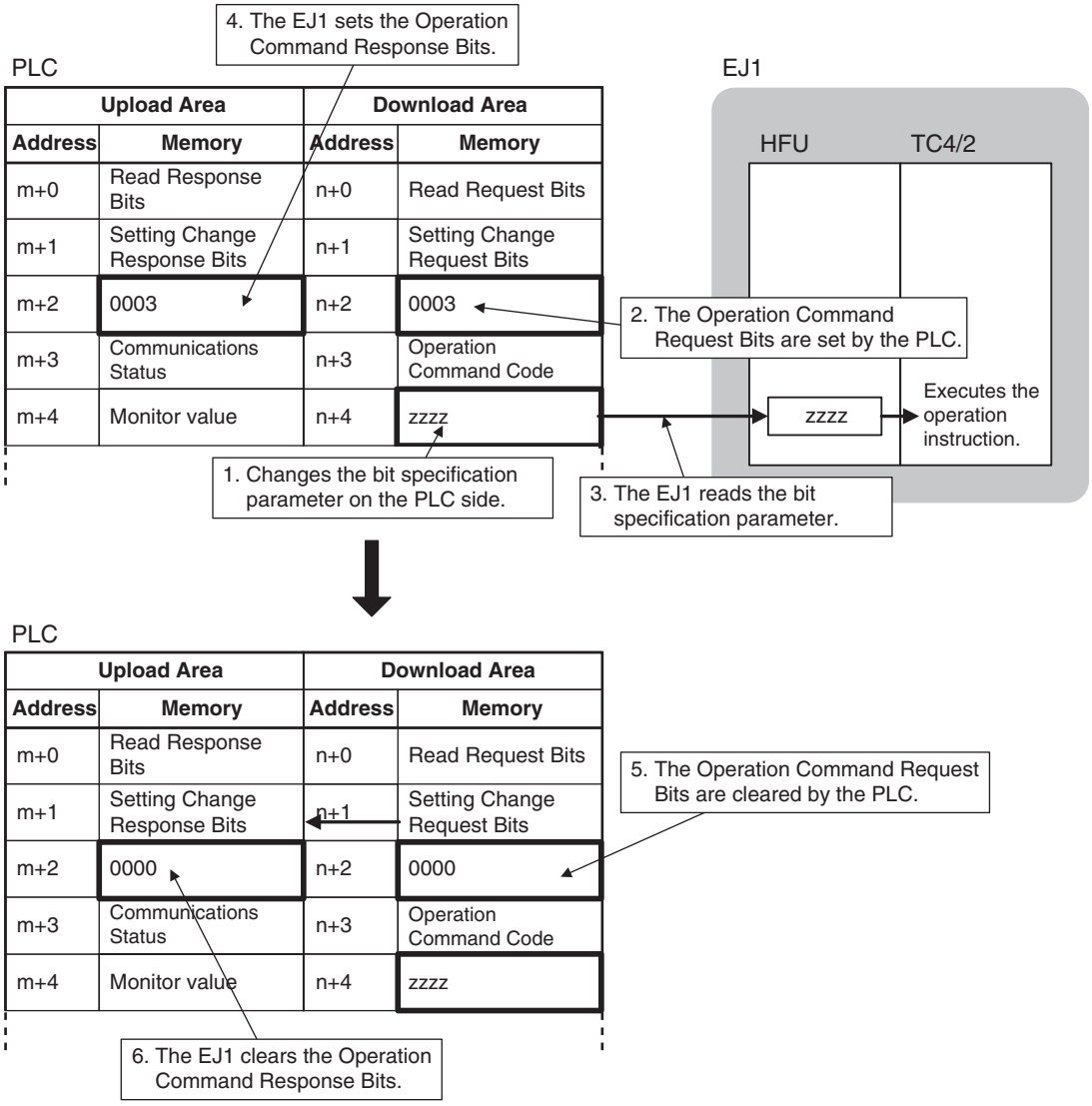
- Multi Operation Commands

  Initially accepts the operation command set in the operation command code, then accepts operation commands each time the operation command code changes.



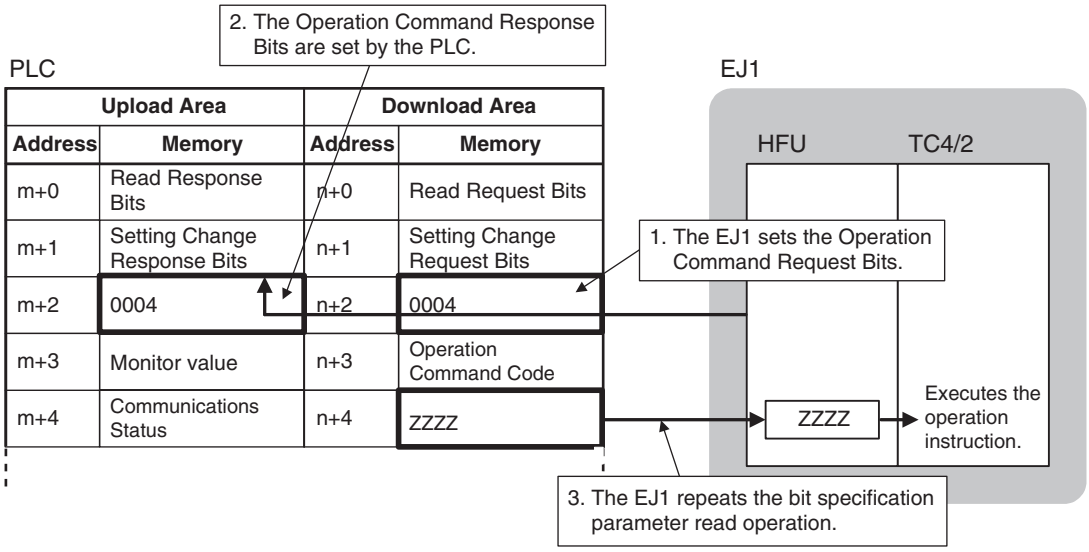
- Single operation instruction (bit specification) **V1.2**

  Executes the bit specification operation commands a single time from among the parameters set in the Download Area Setting.



- Multi Operation Commands (Bit specification)

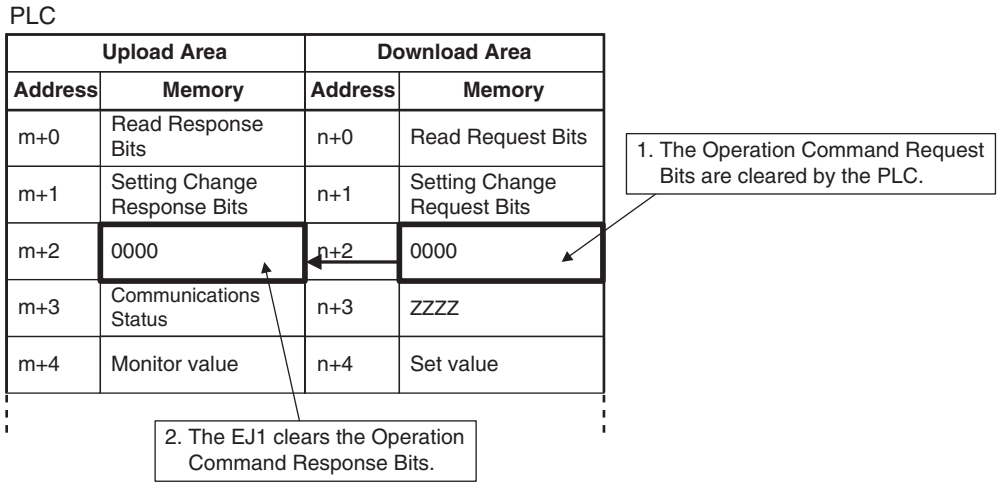
  The first time, all of the bit specified operation commands within the parameters set in the Download Area Setting are issued. Afterwards, only operation commands for channels which have been changed are issued.


2. The Operation Command Response Bits are set by the PLC.
PLC
EJ1
HFU
TC4/2
1. The EJ1 sets the Operation Command Request Bits.
ZZZZ
Executes the operation instruction.
3. The EJ1 repeats the bit specification parameter read operation.

PLC			
Upload Area		**Download Area**	
Address	**Memory**	**Address**	**Memory**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	0004	n+2	0004
m+3	Monitor value	n+3	Operation Command Code
m+4	Communications Status	n+4	ZZZZ

- Stop Operation

  Operation is stopped after a series of operations has been completed.



PLC			
Upload Area		**Download Area**	
Address	**Memory**	**Address**	**Memory**
m+0	Read Response Bits	n+0	Read Request Bits
m+1	Setting Change Response Bits	n+1	Setting Change Request Bits
m+2	0000	n+2	0000
m+3	Communications Status	n+3	ZZZZ
m+4	Monitor value	n+4	Set value

Reducing Communications Time

Try the following measures if communications are slow. Communications time may be reduced depending on the conditions.

Check point	Meaning
Port C Send Wait Time	Reduce the setting to reduce the communications wait time, except when the programless communications protocol is NT Link (1: N).
Programless Upload/ Download Settings	Reduce the volume of communications data by reducing the number of set values. This may reduce the communications time. Review these settings based on system requirements.

Note The above measures may result in an inability to communicate. It is recommended that a record is kept of the set values when communications are successful, to ensure recovery is possible.

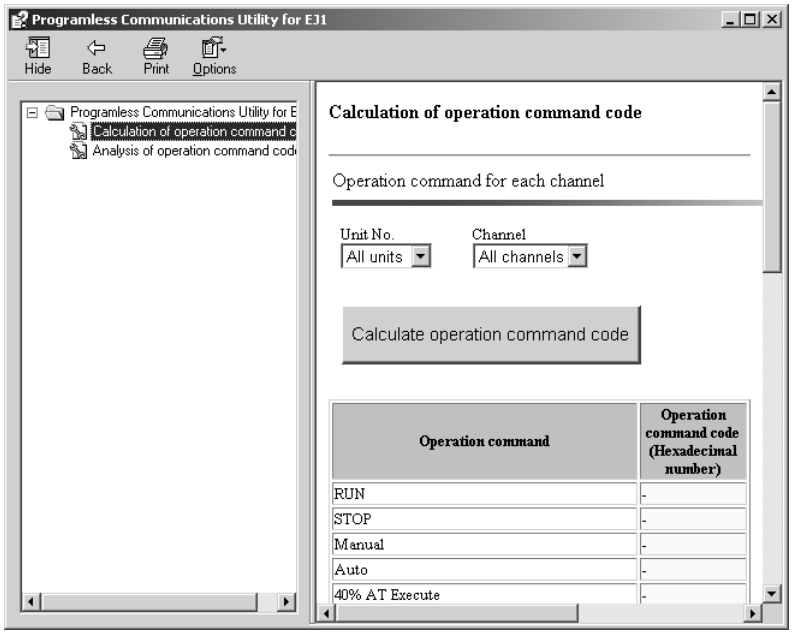
5-1-5 Operation Command Codes for Programless Communications

The following parameters are executed using operation commands.

- Write mode
- Software Reset
- Run
- Stop
- Manual
- Auto
- AT Execute
- AT Cancel
- Bank 0 Change to Bank 3 Change
- Alarm 1 to Alarm 3 Latch Cancel
- All Alarm Latch Cancel
- Save RAM Data
- Register Unit Configuration

Command codes for programless communications operation commands differ from command codes in CompoWay/F communications because the data length is limited to 16 bits.

Operation command codes for programless communications can be checked using the Programless Communications Utility for EJ1 in the CX-Thermo Support Software.



The Programless Communications Utility for EJ1 can be started under ***Start - Program - OMRON - CX-one - CX-Thermo - Programless Communications Utility for EJ1***.

Example Calculation of Operation Command Codes for Programless Communications

Unit No.	Channel	Operation command	Operation command code (hexadecimal)
All units	All channels	Run	2809
		Stop	2C09
		Manual	3009
		Auto	3409
		40% AT Execute	3809
		100% AT Execute	3C09
		AT Cancel	4009

Any unit number between 0 and 31 or all Units can be selected.
Any channel between 1 and 4 or all channels can be selected.

Structure of Operation Command Codes for Programless Communications

Bit position	Meaning
0	All channels specified (1 bit)
1	Related information (2 bits)
2	
3	All Units specified (1 bit)
4	Unit specification (6 bits)
5	
6	
7	
8	
9	
10	Command code (6 bits)
11	
12	
13	
14	
15	

Details of Operation Command Codes for Programless Communications

	Command code						Unit specification									
									All Units specified					Related Information		All channels specified
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write Mode	0	0	0	1	0	0							(See note 1.)	(See note 3.)		0
Software Reset	0	0	0	1	1	0								0	0	0
Run	0	0	1	0	1	0								(See note 4.)		(See note 2.)
Stop	0	0	1	0	1	1										
Manual	0	0	1	1	0	0										
Auto	0	0	1	1	0	1	No. 0									
40% AT Execute	0	0	1	1	1	0	0	0	0	0	0	0				
100% AT Execute	0	0	1	1	1	1	No. 1									
AT Cancel	0	1	0	0	0	0	0	0	0	0	0	1				
Bank 0 Change	0	1	1	1	1	0	No. 2									
Bank 1 Change	0	1	1	1	1	1	0	0	0	0	1	0				
Bank 2 Change	1	0	0	0	0	0	No. 3									
Bank 3 Change	1	0	0	0	0	1	0	0	0	0	1	1				
Local SP Change	1	0	0	0	1	0			⋮							
Remote SP Change	1	0	0	0	1	1										
Reset Error	1	0	1	1	0	1								0	0	0
Alarm 1 Latch Cancel	1	1	0	0	1	0	No. 31							(See note 4.)		(See note 2.)
Alarm 2 Latch Cancel	1	1	0	0	1	1	0	1	1	1	1	1				
Alarm 3 Latch Cancel	1	1	0	1	0	0										
All Alarm Latch Cancel	1	1	0	1	0	1										
Save RAM Data	1	1	0	1	1	1								0	0	1
Register Unit Configuration	1	1	1	0	1	1								(See note 5.)		0

(1) 0: Specified Unit; 1: All Units

(2) 0: According to related information; 1: All channels

(3) 00: Backup; 01: RAM

(4) 00: Channel 1, 01: Channel 2, 10: Channel 3, 11: Channel 4

(5) 00: Clear, 01: Register

Example: Operation Command Code to execute Run for channel 1 of Unit No. 1

Command code for Run						Unit specification: 01							Channel 1		
0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0
H' 2				H'8		H' 1						H' 0			
H' 2810															

Sample Operation Command Codes for Programless Communications

*1: All Units specified. *2: All channels specified.

Command code	Unit No.	Channel	Operation command code	Command code						Unit specification						*1	Related information		*2
Run	1	Channel 1	H' 2810	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0
		Channel 2	H' 2812	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0
		Channel 3	H' 2814	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0
		Channel 4	H' 2816	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	0
		All channels	H' 2811	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1
	2	Channel 1	H' 2820	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
		Channel 2	H' 2822	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0
		Channel 3	H' 2824	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0
		Channel 4	H' 2826	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	0
		All channels	H' 2821	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1
	All Units	All channels	H' 2809	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1
Stop	1	Channel 1	H' 2C10	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0
		Channel 2	H' 2C12	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0
		Channel 3	H' 2C14	0	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0
		Channel 4	H' 2C16	0	0	1	0	1	1	0	0	0	0	0	1	0	1	1	0
		All channels	H' 2C11	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	1
	2	Channel 1	H' 2C20	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0
		Channel 2	H' 2C22	0	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0
		Channel 3	H' 2C24	0	0	1	0	1	1	0	0	0	0	1	0	0	1	0	0
		Channel 4	H' 2C26	0	0	1	0	1	1	0	0	0	0	1	0	0	1	1	0
		All channels	H' 2C21	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	1
	All Units	All channels	H' 2C09	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	1
100% AT Execute	1	Channel 1	H' 3C10	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0
		Channel 2	H' 3C12	0	0	1	1	1	1	0	0	0	0	0	1	0	0	1	0
		Channel 3	H' 3C14	0	0	1	1	1	1	0	0	0	0	0	1	0	1	0	0
		Channel 4	H' 3C16	0	0	1	1	1	1	0	0	0	0	0	1	0	1	1	0
		All channels	H' 3C11	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1
	2	Channel 1	H' 3C20	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0
		Channel 2	H' 3C22	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0
		Channel 3	H' 3C24	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0
		Channel 4	H' 3C26	0	0	1	1	1	1	0	0	0	0	1	0	0	1	1	0
		All channels	H' 3C21	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	1
	All Units	All channels	H' 3C09	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	1
AT Cancel	1	Channel 1	H' 4010	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
		Channel 2	H' 4012	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
		Channel 3	H' 4014	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0
		Channel 4	H' 4016	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0
		All channels	H' 4011	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	2	Channel 1	H' 4020	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
		Channel 2	H' 4022	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0
		Channel 3	H' 4024	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
		Channel 4	H' 4026	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	0
		All channels	H' 4021	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	All Units	All channels	H' 4009	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1

5-1-6 Bit-specified Operation Commands

RUN/STOP, AT Execute/Cancel, Auto/Manual, and other operation commands can be executed by turning bits ON or OFF. Settings for the parameters for these operation commands can be made only using programless download settings.

⚠ Caution

- The following parameters operate by setting the Operation Command Request Bit to 0003: Single (bit specification), or to 0004: Multi (bit specification). Refer to *5-1-4 Description of Operation* for details.
- Do not execute operation commands on communication unit numbers that do not exist.
- When using parameters for both the TC4 and TC2, with duplicate communications unit numbers, only the data that corresponds to an existing TC2/TC4 communications unit number will be reflected.

Example: When TC2 (No. 0) and TC4 (No. 1) are connected to the HFU, the data indicated in gray shading in the following table will be reflected.

For TC2	No.7		No.6		No.5		No.4		No.3		No.2		No.1		No.0	
	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1
For TC4	No.3				No.2				No.1				No.0			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

For TC2

RUN/STOP, AT Execute/Cancel, and Auto/Manual parameters are available as follows. By turning the respective bit ON or OFF, the operation command for the channels of the corresponding communications unit number is executed.

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
No.00 to 07	No.7		No.6		No.5		No.4		No.3		No.2		No.1		No.0	
	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1
No.08 to 15	No.15		No.14		No.13		No.12		No.11		No.10		No.9		No.8	
	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1
No.16 to 23	No.23		No.22		No.21		No.20		No.19		No.18		No.17		No.16	
	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1
No.24 to 31	No.31		No.30		No.29		No.28		No.27		No.26		No.25		No.24	
	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1	CH2	CH1

For TC4

RUN/STOP, AT Execute/Cancel, and Auto/Manual parameters are available as follows. By turning the respective bit ON or OFF, the operation command for the channels of the corresponding communications unit number is executed.

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
No.00 to 03	No.3				No.2				No.1				No.0			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.04 to 07	No.7				No.6				No.5				No.4			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.08 to 11	No.11				No.10				No.9				No.8			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

No.12 to 15	No.15				No.14				No.13				No.12			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.16 to 19	No.19				No.18				No.17				No.16			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.20 to 23	No.23				No.22				No.21				No.20			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.24 to 27	No.27				No.26				No.25				No.24			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1
No.28 to 31	No.31				No.30				No.29				No.28			
	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

Parameter	Bit	Executed operation command
RUN/STOP	ON	RUN
	OFF	STOP
AT Execute/Cancel	ON	100% AT Execute
	OFF	AT Cancel
Auto/Manual	ON	Switch to Manual Mode
	OFF	Switch to Auto Mode

Note

(1) When allocating the above parameters in the Programless Download Setting, be sure to allocate RUN/STOP and Auto/Manual before allocating AT Execute/Cancel. If AT Execute/Cancel is allocated before the others, AT Execute cannot be executed simultaneously with RUN or Auto.

(2) Even if AT execution has finished or been canceled, the bit that was turned ON with AT Execute/Cancel will not turn OFF automatically. If the bit is left ON, AT may start unexpectedly, such as during a system reboot, so make sure to turn OFF the bit when AT finishes or is canceled. The status while AT is executing can be checked using the channel status bit 2 (AT Execute/Cancel).

(3) Bit-specified operation commands may not function properly for distributed positioning if power is turned ON to a TC that is beyond the HFU or if the HFU cannot detect the TC due to noise or other factors. If this occurs, use an operation command to reset the HFU.

5-1-7 Programless Communications Errors

Possible Causes of Parameter Access Problems

- A value outside the setting range was written.
- A non-existent Unit was accessed.
- An attempt was made to change a setting for which changes are prohibited. Example: An attempt was made to change the SP during autotuning.

In the above cases, the Response Bits will be set to the following error values.

Bits	Operation	Error value
Read Response Bits	Single Read	8001
	Multi Read	8002
Setting Change Response Bits	Single Action	8001
	Multi action	8002
Operation Command Response Bits	Single Operation Commands	8001
	Multi Operation Commands	8002
	Single (bit specification) operation command **V1.2**	8003
	Multi (bit specification) operation command **V1.2**	8004

If an error value is set for Response Bits, check the following items.

- Setting range
- Unit number
- Whether or not the value being changed can be changed.

Use the following procedure to clear error values.

1,2,3...

1. Set the Response Bits to 0000 (stop operation) for the Request Bits for which the error value was set.
2. Check the communications unit number and setting range, be sure that the present value can be changed, and correct the error.
3. Set the Request Bits again.

Errors in Communications with PLCs

If noise or other cause results in a communications error with the PLC, the EJ1 will stop programless communications and set the Operation Command Response Bits to EEEE. (With version **V1.1** , however, communications will be stopped only when the Selection of Programless Communications Operation during Error parameter is set to 1 (stop).)

■ **Method for Canceling Communications Errors**

1,2,3...

1. Set the Operation Command Request Bits to FFFF.
2. The Operation Command Response Bits will be set to FFFF and the programless communications will return to the initial status.

   Note If the Read Request Bits or Setting Change Request Bits are set, restart operation according to the request.
3. Set the Operation Command Request Bits to 0000, then check that the Operation Command Response Bits have been set to 0000.

   Note Operation commands cannot be executed while the Operation Command Response Bits are set to FFFF.

If the communications line is disconnected or the PLC power supply turns OFF during programless communications, a programless communications error will occur after the following times have expired.

Programless communications protocol	Maximum time until programless communications error
NT Link (1: N)	30 s (See note.)
MC Protocol (Format 5) AnA/AnU CPU Common Commands	Programless Communications Receive Wait Times × 3 (6 s for the default setting)

Note If a programless communications error occurs because the PLC power supply turns OFF when using the NT Link (1: N) protocol, the error can be cleared by turn ON the PLC power supply.

5-2 Connecting More Than One HFU V1.1

5-2-1 SYSMAC CS/CJ-series PLCs

Up to eight Advanced Units (HFU) can be connected to one communications port on a Serial Communications Unit or Serial Communications Board. Use the following models when connecting more than one HFU.

Serial Communications Units	CJ1W-SCU31-V1 Port 1 of CJ1W-SCU41-V1 CS1W-SCU31-V1
Serial Communications Board	Port 2 of CS1W-SCB41-V1
EJ1N-HFU	EJ1N-HFUA-NFLK EJ1N-HFUB-NFLK

1,2,3... 1. Connect the EJ1 and PLC.

Always set the communications unit numbers of the HFU in order from 0 through 7, or 32 to 39 if using a version V1.2 Unit, and set the communications unit numbers of the Basic Units connected to each HFU to a different communications unit number than the HFU. This restriction does not apply if using a version V1.2 Unit when the communications unit number for the HFU is set to a number from No. 32 to 39.

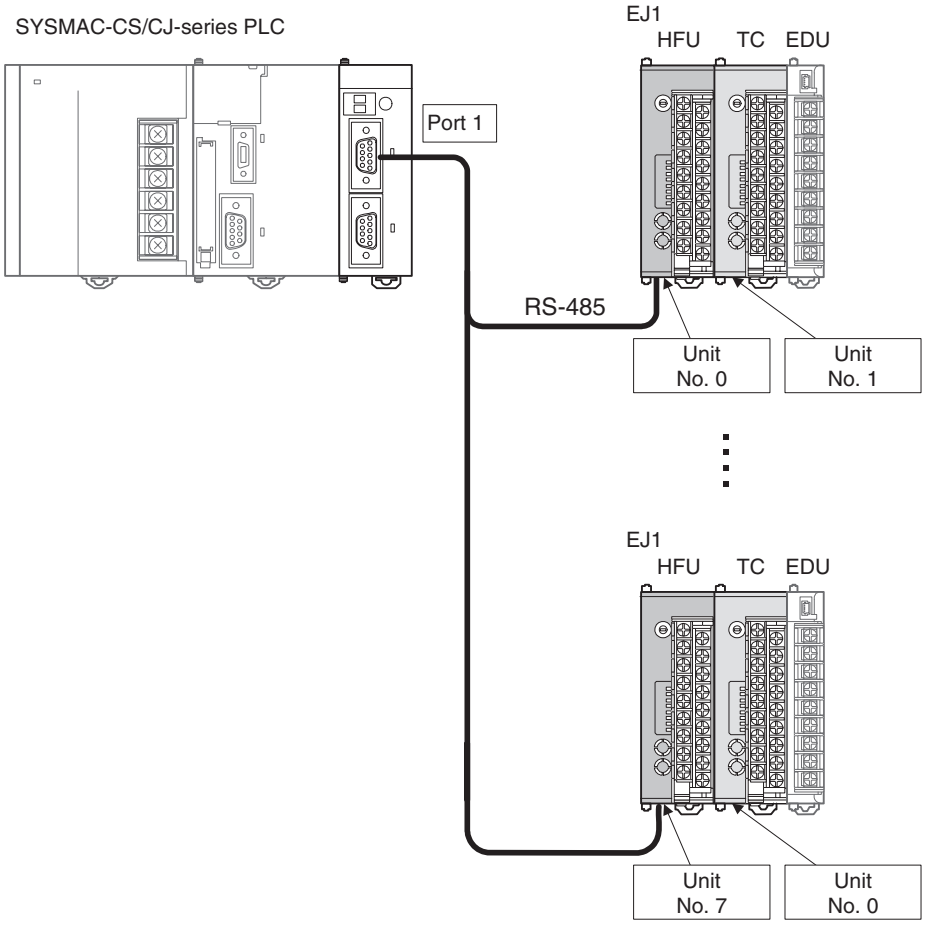
■ Example

If the communications unit number of the HFU is set to 1:

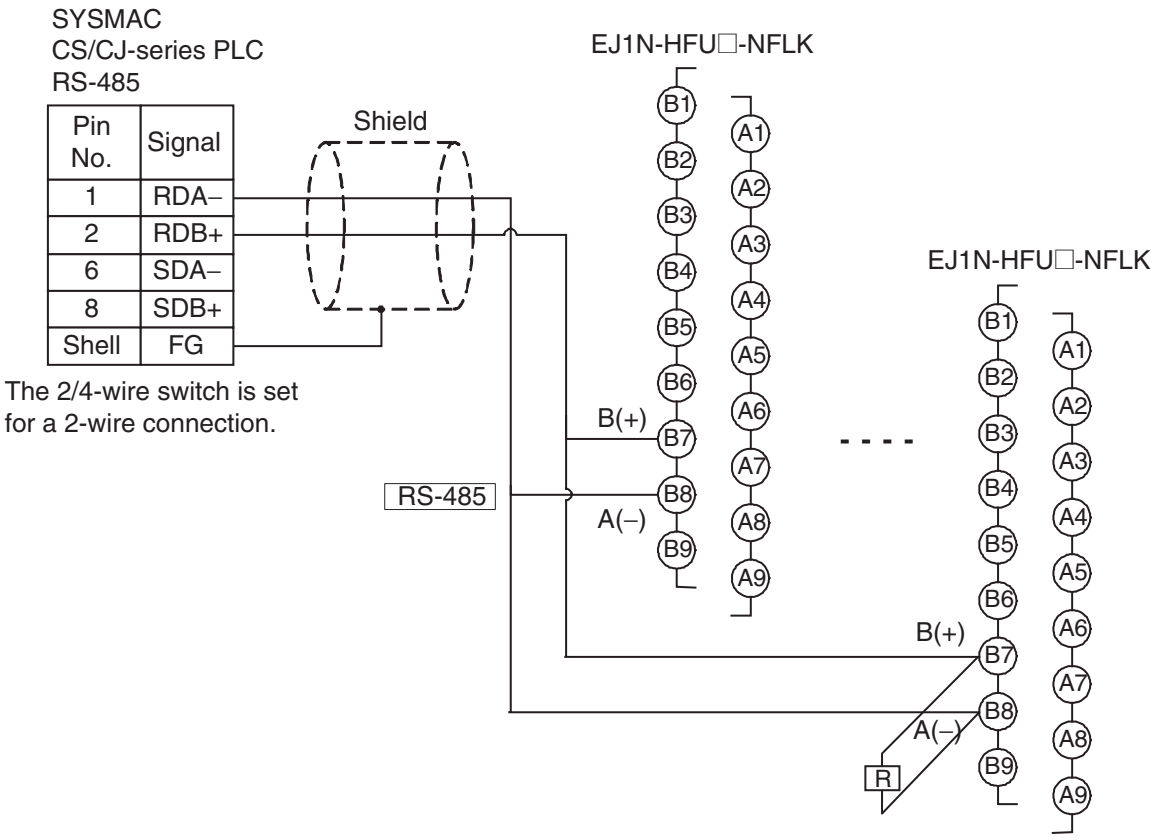
Set the unit numbers of the Basic Units to any number other than 1, i.e., from 0 to 31 but excluding 1.

Set the unit numbers for other HFUs to a number other than 1, for example, 0, 2, 3, 4, 5, 6, or 7. A single HFU can manage a maximum of 32 Basic Units. When connecting 16 or more Basic Units, use distributed placement because 16 would exceed the maximum number of side-by-side connections.

RS-485



Note Set the unit number of the Basic Unit to any number that was not set for the HFU.



2. Make the PLC settings.

   Referring to item *2. Make the PLC settings.* on page 121, set the maximum unit number to one less than the number of connected HFU units. Other settings are the same.

■ **Example**

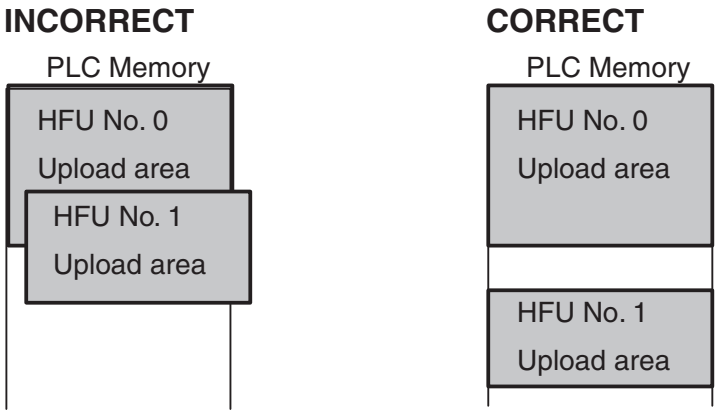
If three HFUs are connected, set the maximum unit number to 2.

3. Make the EJ1 settings.

   Make the following setting in all HFUs that are connected.

Variable type	Parameter name	Setting/Monitor values
F0/B0	Programless Communications Protocol	2: NT Link (1: N)

Refer to *5-1-3 Detailed Settings* for information on data linked with the PLC. Be sure that the areas of PLC memory used by the different HFUs do not overlap.



Operation and Precautions

■ **Read/Write Period for PLC Memory**

When more than one HFU is connected, communications will be performed in the following order according to communications unit numbers. The read/write period for PLC memory will thus be relatively long in comparison to the read/write period for a 1:1 connection.

0 → 1 → 2 … Max. communication unit number → 0 → 1 …

Or, 32 → 33 → 34 … Max. communication unit number → 32 → 33 … **V1.2**

■ **Startup**

When the power is turned ON, communications will be started in order of the communications unit numbers.

■ **Power Interruptions**

If power is interrupted to one HFU, communications will still continue for the other HFUs.

5-2-2 MELSEC-Q/QnA/QnAS-series PLCs

Up to eight Advanced Units (HFU) can be connected to one communications port on a Serial Communications Unit. Use the following models when connecting more than one HFU.

Serial Communications Units	Channel 2 of QJ71C24N QJ71C24N-R4 Channel 2 of A1SJ71QC24N Channel 2 of AJ71QC24N AJ71QC24N-R4
EJ1N-HFU	EJ1N-HFUA-NFL2 EJ1N-HFUB-NFL2

1,2,3... 1. Connect the EJ1 and PLC.

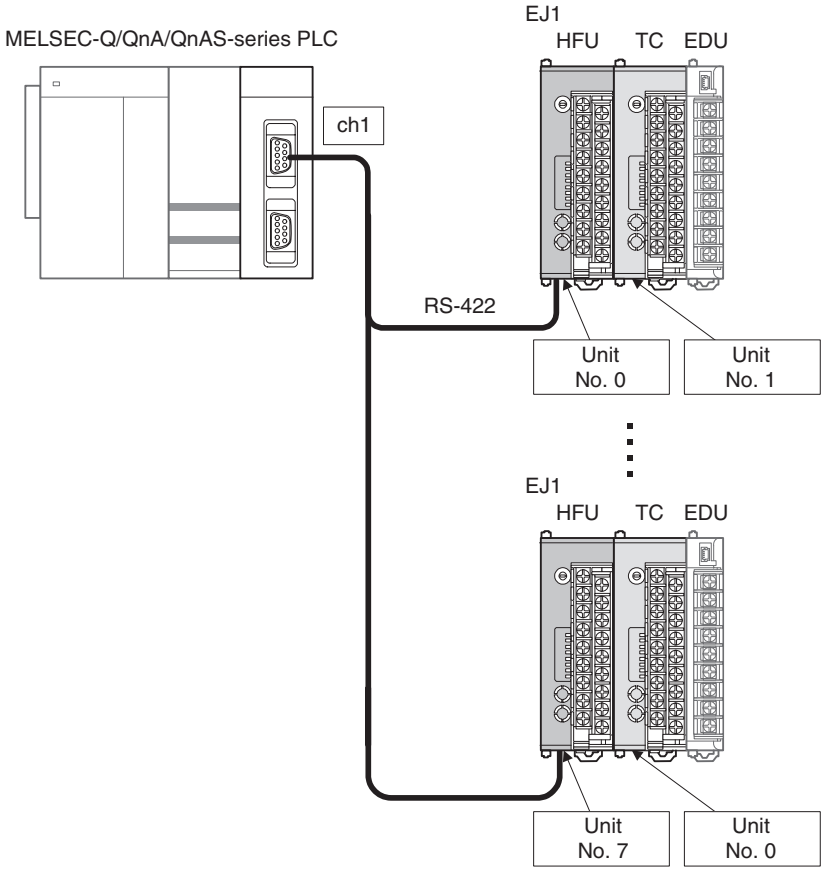
Always set the communications unit numbers of the HFU in order from 0 through 7, or 32 to 39 if using a version **V1.2** Unit, and set the communications unit numbers of the Basic Units connected to each HFU to a different communications unit number than the HFU. (This restriction does not apply when the communications unit number for the HFU is set to a number from No. 32 to 39. **V1.2**)

■ **Example**

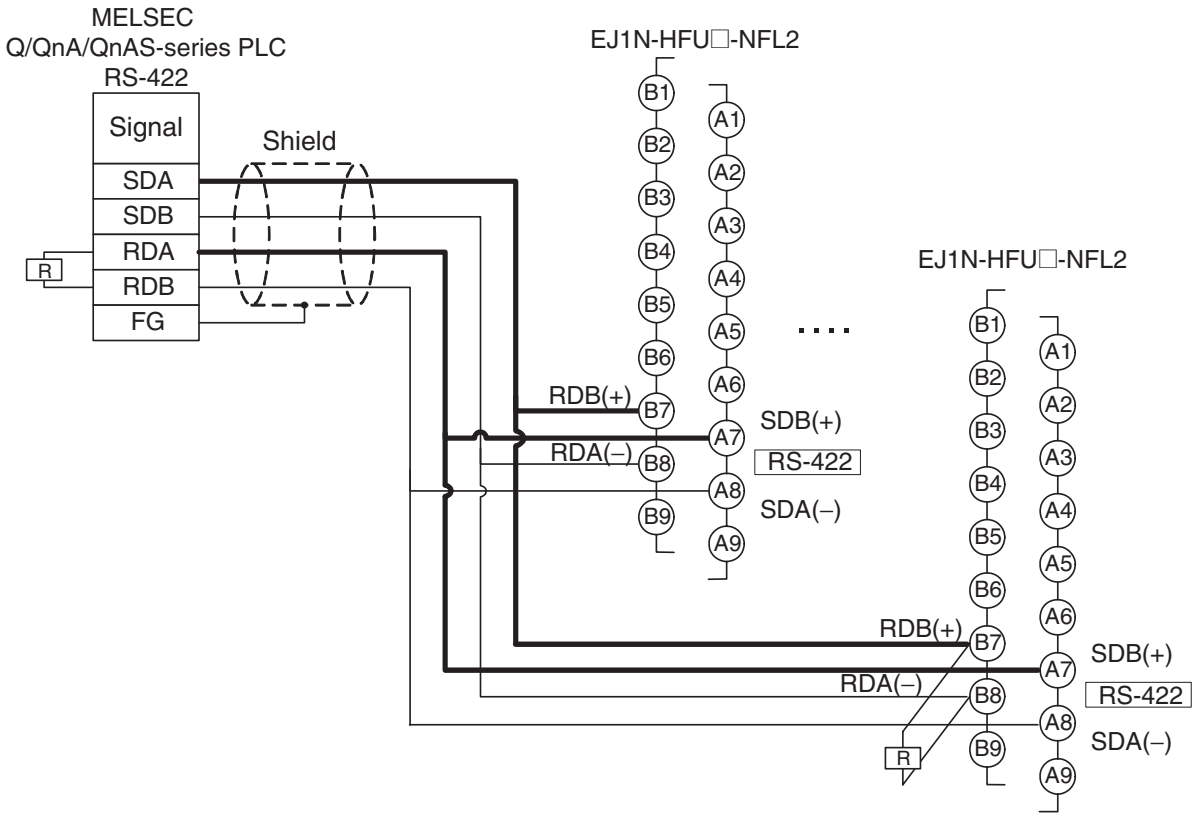
The communications unit number of the Basic Unit is set to a number from 0 to 31, excluding 1.

Set the communications unit number of another HFU to 0, 2, 3, 4, 5, 6, or 7, i.e., any number other than 1. One HFU can control up to 32 Basic Units. When connecting 16 or more Basic Units, use distributed placement because 16 would exceed the maximum number of side-by-side connections.

• RS-422



Note Set the unit number of the Basic Unit to any number that was not set for the HFU.



2. Make the PLC settings.

   Refer to *Make the PLC settings.* on page 125

3. Make the EJ1 settings.

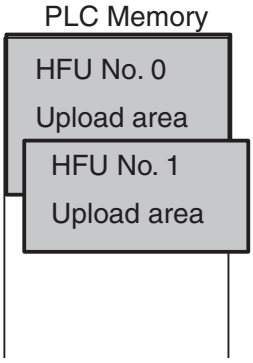
   Make the following setting in all HFUs that are connected.

Variable type	Parameter name	Setting/Monitor values
F0/B0	Port C Send Wait Time	1: 1 ms
	Programless Communications Protocol	5: MC protocol (format 5)
	Programless Communications Maximum Unit Number (See note.)	Set the unit number to one less than the number of HFU units that are connected.

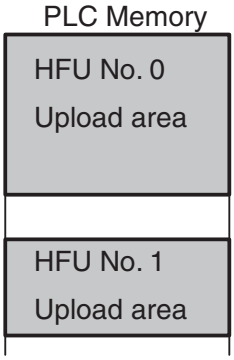
Note If three HFUs are connected, set the maximum unit number to 2.

Refer to *5-1-3 Detailed Settings* for information on data linked with the PLC. Be sure that the areas of PLC memory used by the different HFUs do not overlap.

INCORRECT



CORRECT



Operation and Precautions

■ Read/Write Period for PLC Memory

When more than one HFU is connected, communications will be performed in the following order according to communications unit numbers. The read/write period for PLC memory will thus be relatively long in comparison to the read/write period for a 1:1 connection.

0 → 1 → 2 … Max. communication unit number → 0 → 1 …

Or, 32 → 33 → 34 … Max. communication unit number → 32 → 33 … **V1.2**

■ Startup

When more than one HFU is connected, the HFU with communications unit number 0 is the master for the EJ1. If using a version **V1.2** Unit, unit number 32 is the master for the EJ1.

Other HFUs will start communications after the master starts communications. Be sure to turn ON the power to the master HFU first.

For HFUs that are not the master, communications will start even if the power is not turned ON. If the power to an HFU is not ON, communications standby time will occur, and so communications will increase in length by the time required for one cycle of communications with all Units.

■ Power Interruptions

If power is interrupted to one HFU, communications will still continue for the other HFUs. A communications standby time will occur for the HFU that does not have power, and so communications will increase in length by the time required for one cycle of communications with all Units.

The operation of the HFU after power is restored is different for the master HFU and other HFUs.

Master HFU	A programless link error may occur depending on when the master HFU is started. If the Selection of Programless Communications Operation during Error parameter is set to continue operation, then communications will recover automatically after power is restored.
Other HFUs	Communications will recover automatically after power is restored.

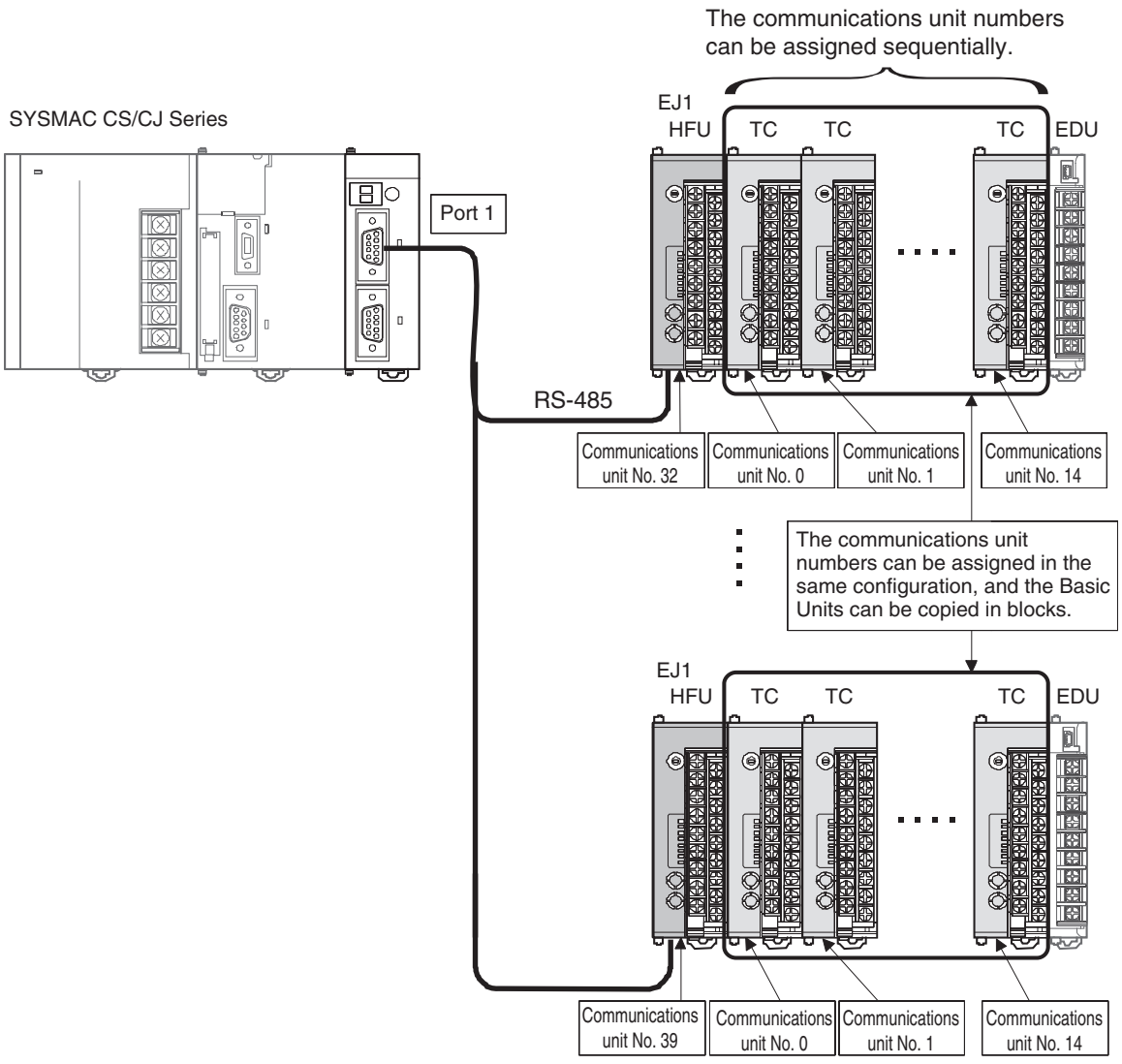
5-2-3 HFU Communications Unit No.

In addition to 0 through 7, 32 through 39 can also be used as HFU communications unit numbers. Setting the communications unit number to 32 through 39 will result in the following improvements.

- Even when using 32 Basic Units, the communications unit numbers can be assigned sequentially, simplifying the settings for communications unit numbers, including those for HFUs.
- The communications unit numbers for Basic Units can be assigned starting from No. 0, allowing bit specification operation commands to be effectively used.
- If the Basic Units connected to the HFUs are all the same model, the HFU and Basic Unit settings can be copied to other HFUs and Basic Units, overwriting the initial settings.

HFU communications unit No. (See note.)	Programless communications operation
32	Same operation as when the communications unit number is 0.
33	Same operation as when the communications unit number is 1.
34	Same operation as when the communications unit number is 2.
35	Same operation as when the communications unit number is 3.
36	Same operation as when the communications unit number is 4.
37	Same operation as when the communications unit number is 5.
38	Same operation as when the communications unit number is 6.
39	Same operation as when the communications unit number is 7.

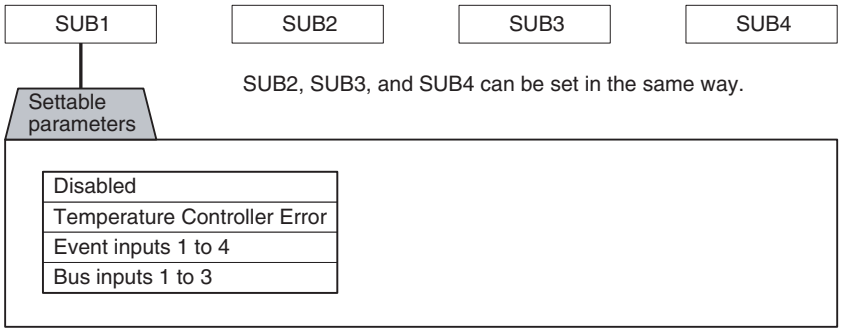
Note When connecting using CX-Thermo, set the Communications Unit that is actually set on the unit.


The communications unit numbers can be assigned sequentially.
SYSMAC CS/CJ Series
Port 1
RS-485
EJ1
HFU
TC
TC
TC
EDU
Communications unit No. 32
Communications unit No. 0
Communications unit No. 1
Communications unit No. 14
The communications unit numbers can be assigned in the same configuration, and the Basic Units can be copied in blocks.
EJ1
HFU
TC
TC
TC
EDU
Communications unit No. 39
Communications unit No. 0
Communications unit No. 1
Communications unit No. 14

5-3 Other HFU Functions

5-3-1 Auxiliary Output Allocations

The parameters that can be set for auxiliary outputs 1 to 4 are outlined below.



Temperature Controller Error	The Temperature Controller Error output will turn ON when any bit between bit 0 and bit 13 is ON in the Device A Status. It can be used to output EJ1 error status. Refer to *Status Lists* on page 256 for details on Device A Status.
Event inputs 1 to 4	Output the ON/OFF status of event inputs 1 to 4.
Bus inputs 1 to 3	Output the ON/OFF status of bus inputs 1 to 3.

Variable type	Parameter name	Setting range	Default
F2/B2	Auxiliary Output 1 Assignment (Common)	0 to 22	20
	Auxiliary Output 2 Assignment (Common)	0 to 22	21
	Auxiliary Output 3 Assignment (Common)	0 to 22	22
	Auxiliary Output 4 Assignment (Common)	0 to 22	0

Conditions for use	No special conditions

Note

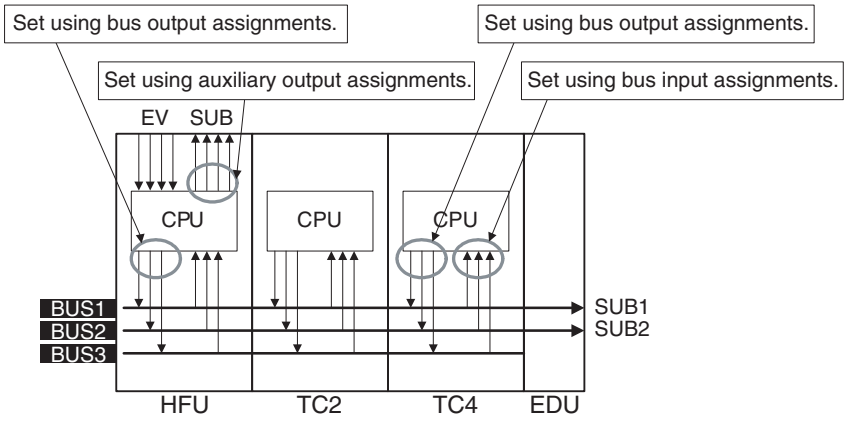
(1) This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.

(2) Refer to *Parameter List* on page 235 for details on parameter settings.

5-3-2 HFU Internal Buses

The EJ1 has three internal device buses. I/O allocations can be made for these buses, which enables simple sequencing to be incorporated by allocating output signals to buses (bus output assignments) and determining operations based on bus status (bus input assignments).

Note Bus inputs cannot be used if a Basic Unit is used without an HFU.
Even if an HFU is used, bus inputs cannot be used for Basic Units connected to the RS-485 communications lines using distributed positioning.



Note (1) BUS1 and BUS2 are connected to SUB1 and SUB2 on the EDU.
(2) HFU event inputs and auxiliary outputs can be linked.
(3) Information output to buses can be accessed by the outputting Unit.

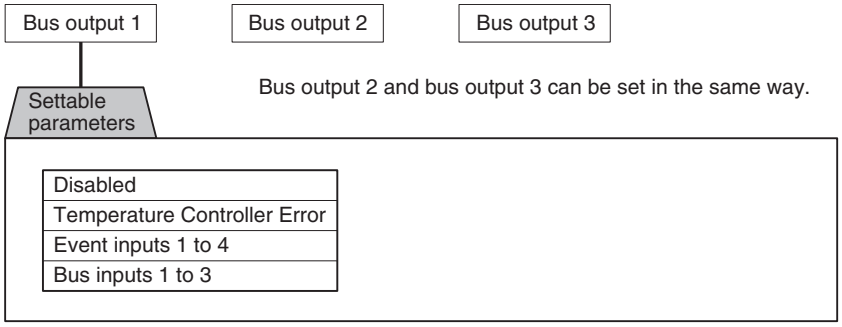
Bus Output Assignment Settings

The parameters that can be set for bus output assignments are outlined below. Refer to the following examples when setting parameters.

Note Make correct bus settings for each Unit, making sure the settings match operations in the EJ1 system.

■ HFU Bus Output Assignments

- The status of functions shown in the following diagram can be allocated to output them to bus outputs 1 to 3.


Bus output 1
Bus output 2
Bus output 3
Bus output 2 and bus output 3 can be set in the same way.
Settable parameters
Disabled
Temperature Controller Error
Event inputs 1 to 4
Bus inputs 1 to 3

Temperature Controller error	The Temperature Controller Error output will turn ON when any bit between bit 0 and bit 13 is ON in the Device A Status. It can be used to output EJ1 error status. Refer to *Status Lists* on page 256 for details on Device A Status.
Event inputs 1 to 4	Outputs the ON/OFF status of event input 1 to event input 4.
Bus inputs 1 to 3	Outputs the status of bus input 1 to bus input 3.

Variable type	Parameter name	Setting range	Default
F2/B2	Bus Output 1 to Bus Output 3 Assignment (Common)	0 to 22	0

Conditions for use	No special conditions

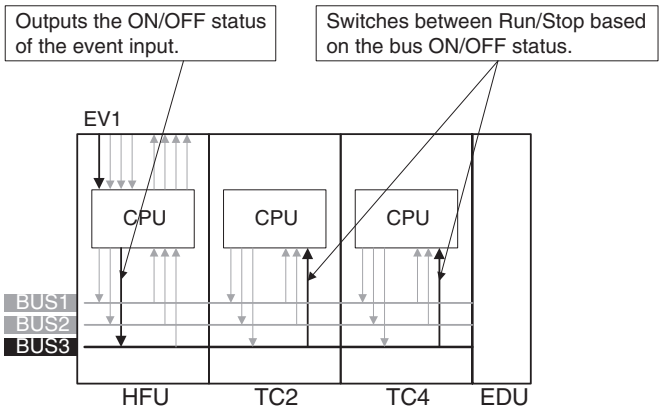
Note This parameter can be set only when operation is stopped.
When this parameter has been changed, the new setting becomes effective the next time a software reset is performed for the Unit or the next time power is turned ON.
Refer to *Parameter List* on page 235 for details on the settings.

- Temperature Controller Error

  The Temperature Controller Error output will turn ON when any bit between bit 0 and bit 13 is ON in the Device A Status. It can be used to output EJ1 error status. Refer *Status Lists* on page 256 for details on Device A Status.

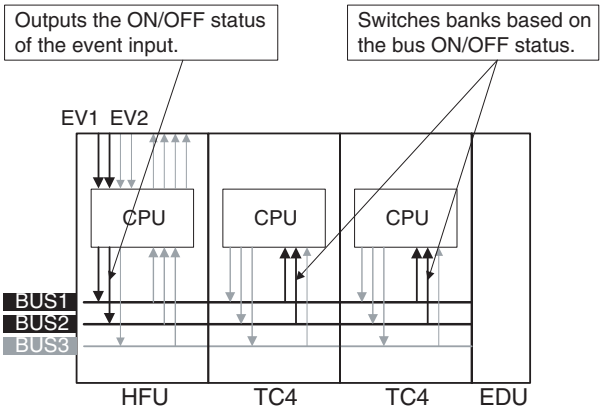
■ Example

Example 1: Switch all channels between Run and Stop according to the ON/OFF status of the event input.



Model	Parameter name	Set Value
HFU	Bus Output 3 Assignment	Event input 1
TC2	Bus Input 3 Assignment	All channels Run (0)/Stop (1)
TC4	Bus Input 3 Assignment	All channels Run (0)/Stop (1)

Example 2: Switch all channel banks according to the ON/OFF status of the event input.



Model	Parameter name	Set Value
HFU	Bus Output 1 Assignment	Event input 1
	Bus Output 2 Assignment	Event input 2
TC4	Bus Input 1 Assignment	Bank for all channels (bit 0)
	Bus Input 2 Assignment	Bank for all channels (bit 1)
	Bus Output 1 Assignment	Disabled
	Bus Output 2 Assignment	Disabled

Note When assigning bus I/O, disable all bus I/O assignments first and then make the settings.

SECTION 6
CompoWay/F Communications

This section describes how to use communications based on communications commands.

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6-1 Communications Settings

Communications are programmed on the host computer. Descriptions of communications in this manual are therefore written from the viewpoint of the host computer. For example, references to reading and writing mean reading data from the EJ1 to the host computer and writing data from the host computer to the EJ1.

The EJ1 uses different communications specifications from existing products to improve communications operability.

Parameter Validity

The conditions for parameter validity that depended on the model and setting status no longer apply.

Fixed Values for Setting Ranges

For example, the setting range for the target value is fixed to −1,999 to 9,999, regardless of the input type. In other words, the setting ranges under the new specifications will not change based on the input type or related parameters.

For parameters that set ranges with upper and lower limits, the specifications now allow the upper and lower limits to be reversed.

Refer to *4-1-3 Analog Inputs, 4-3-4 Setting the Set Point, and MV Limiter* on page 77 *in Section 4 Basic Units (TC4/TC2)* before using the EJ1.

Automatic Offsetting of Setting Values

Accompanying changes outlined under *Fixed Values for Setting Ranges*, above, there are no longer any restrictions in operations for the target value limiter or target values for changes in the input type. Under the new specifications, there is also no need to change control output assignments when operations, such as selecting heating and cooling, are performed.

Refer to *4-2-1 Control Output Assignments, Heating/Cooling Control* on page 69*, and 4-3-4 Setting the Set Point in Section 4 Basic Units (TC4/TC2)* before using the EJ1.

6-1-1 Communications Specifications

Parameter name	Settings
	EDU (Port A/Port B)
Transmission path connection	Multipoint
Communications	RS-485
Synchronization method	Start-stop synchronization
Transmission code	Binary/ASCII
Error detection	BCC (Block Check Character)
Flow control	None
Retry function	None

- The following communications settings are used.
  - EDU (Port A)
    The following settings are fixed.
    - Baud rate: 38.4 kbps
    - Communications data length: 7 (bit)
    - Communications stop bits: 2 (bit)
    - Parity: Even (bit)
  - EDU (Port B)

Parameter name	Setting range	Default	Setting method
Unit number	00 to 63	01	SW1/SW2
Port B communications protocol	0: CompoWay/F 1: Modbus	0: CompoWay/F	Communications
Port B communications baud rate	3: 9.6 4: 19.2 5: 38.4 6: 57.6 7: 115.2 (kbps)	3: 9.6 (kbps)	Communications or SW2 **V1.2**
Port B communications data length	0: 7 1: 8 (bit)	0: 7 (bit)	Communications
Port B communications stop bits	0: 1 1: 2 (bit)	1: 2 (bit)	Communications
Port B communications parity	0: None 1: Even 2: Odd (bit)	1: Even (bit)	Communications
Port B send data wait time	0 to 99 (ms)	5 (ms)	Communications

Note Always set the port B communications protocol to CompoWay/F (0). When using **V1.2**, always keep pin 3 on SW2 turned OFF.

6-1-2 Unit Number Setting

The unit number is set first. The setting is made on SW1 and SW2 on the front of the EJ1. For information on the setting method, refer to *1-1-4 Using Setting Switches*.

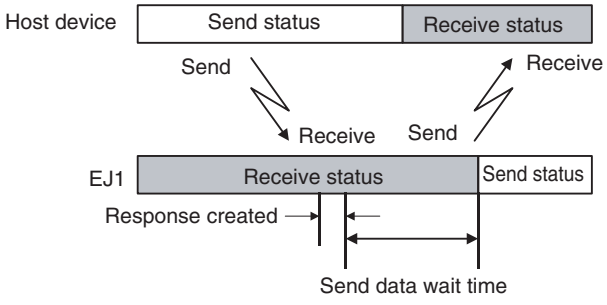
6-1-3 Other Communications Settings

The communications baud rate, communications data length, communications stop bits, communications parity, and send data wait time are set using communications. When using **V1.2**, the baud rate can be set on SW2. Refer to *6-4-2 Write to Variable Area* for the setting procedure. Use communications with the default communications settings to change any of these settings.

Refer to *6-4-2 Write to Variable Area* for information on how to change settings. When the above settings are changed, the changes will not be enabled until the EJ1 is reset or the power is cycled.

6-1-4 Send Data Wait Time

The send data wait time setting is used to adjust the time the host computer takes to switch from sending to receiving. Specifically, the send data wait time for the EJ1 is the time from after a response has been created after data has been received until the EJ1 switches to sending.



The setting of the Send Wait Time parameter can be shortened to reduce the communications time at the host device as long as there are no problems.

6-2 Frame Configuration

The communications protocol is CompoWay/F.

Commands from the host computer and responses from the EJ1 are contained in data blocks called frames.

The structures of the command and response frames are described below.

In the following explanations, hexadecimal values are expressed by adding the suffix H after the number, e.g., 02H.

All other alphanumeric values in the explanations indicate ASCII characters.

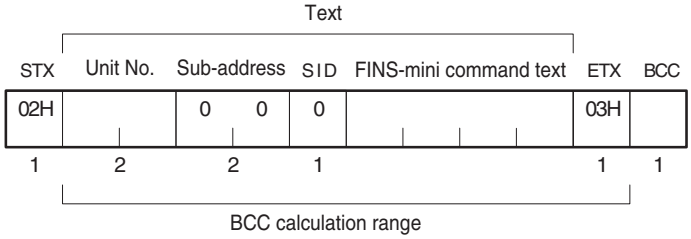
Note CompoWay/F

CompoWay/F is OMRON's standard communications format for general serial communications.
It uses commands compliant with the well-established FINS used extensively with OMRON Programmable Controllers together with a consistent frame format to facilitate communications between more than one component and between personal computers and components.

FINS (Factory Interface Network Service)

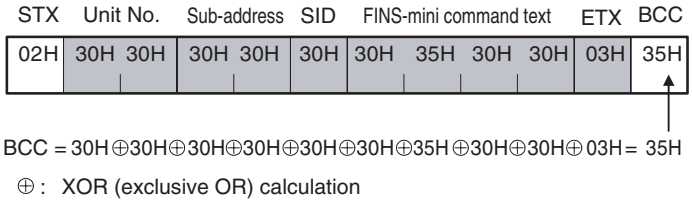
The FINS protocol provides message communications between controllers in OMRON FA networks.

Command Frame Format



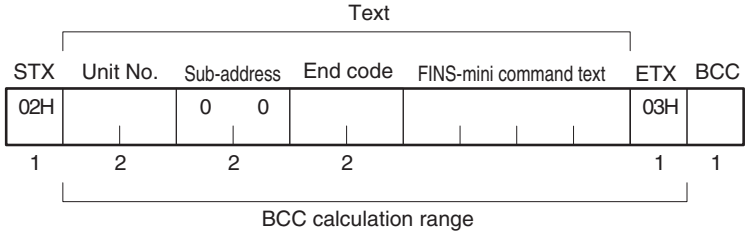
STX	This code indicates the beginning of the communications frame. Always set to 02H.
Unit No.	• Set the unit number that is set on SW1 and SW2 on the EJ1. • Specify “XX” for a broadcast transmission. No responses will be returned for broadcast transmissions. • No responses will be returned from unit numbers other than the ones in the above range.
Sub-address	Not used by the EJ1. Always set to 0.
SID	Not used by the EJ1. Always set to 0.
FINS-mini command text	This text is the command. For details, refer to *6-3 FINS-mini Text*.
ETX	This code indicates the end of the communications frame. Always set to 03H.
BCC	The BCC calculation result from the unit number to the ETX.

BCC Calculation Example



Note No response will be returned unless the frame contains all elements up to the ETX and BCC.

Response Frame



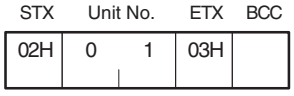
End Codes

End code	Name	Meaning	Error detection priority
0F	FINS command error	The specified FINS command could not be executed.	8
10	Parity error	The OR of 1 bits in received data does not match the setting for the communications parity.	2
11	Framing error	Stop bit is 0.	1
12	Overrun error	The next data was received when the reception data buffer was full.	3
13	BCC error	The calculated BCC value is different from the received BCC value.	5
14	Format error	The FINS-mini command text contains characters other than 0 to 9 and A to F. For details on the echoback test, refer to *6-4-10 Echoback Test*. SID and the FINS-mini command text are not included.	7
16	Sub-address error	The sub-address is not included.	6
18	Frame length error	The received frame exceeds the specified number of bytes.	4
00	Normal completion	Command processing was completed normally.	None

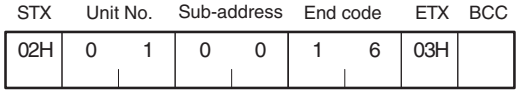
■ **End Code Example**

When the Sub-address, SID, and FINS-mini Command Text Are Not Included

- Command



- Response



The sub-address is “00” and the end code is “16” (sub-address error).

6-3 FINS-mini Text

The FINS-mini command and response text is the text that form the command and response communications.

6-3-1 PDU Structure

The structure of the FINS-mini command text and FINS-mini response text are described below.

Command Text

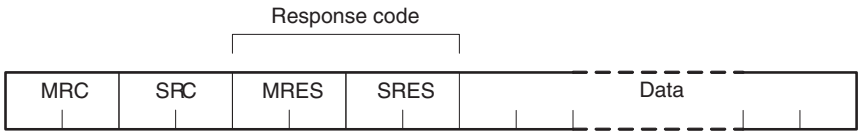
An MRC (main request code) and SRC (sub-request code) followed by the various required data is transferred in the command frame.

Service Response PDU

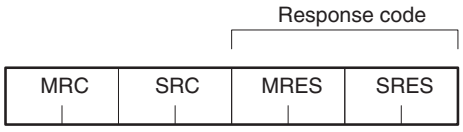
Response Text

The MRES (main response code) and SRES (sub-response code) are transferred in the response frame following the above MRC/SRC. Data is then transferred following the MRES and SRES.

Service Response PDU (Normal Response)



Service Response PDU (FINS-mini Command Text Not Executed)



Note If the specified FINS-mini command text could not be executed, only the MRC/SRC and MRES/SRES are used in the target response PDUs.
The MRES and SRES are used in the response code when processing did not end in a normal completion.

6-3-2 Variable Type and Address

Note Refer to *Parameter List* on page 235.

6-3-3 Number of Elements

The number of elements is expressed in 2-byte hexadecimal format.

The range for specifying the number of elements differs for each command. Refer to *6-4 Detailed Description of Services*.

6-3-4 Communications Data

Setting (monitor) value	Communications data (See note.)	Negative values	Decimal point
Hexadecimal	Double word (8 digits) Word (4 digits)	2's complement	The decimal point is removed and the result is converted to hexadecimal. Example: 105.0 → 1050 → 0000041A (8 digits) 105.0 → 1050 → 041A (4 digits)

Note Refer to *Parameter List* on page 235.

6-3-5 List of FINS-mini Command Services

For details on each service, refer to *6-4 Detailed Description of Services*.

MRC	SRC	Name of service	Processing	TC4/TC2	HFU
01	01	Read from variable area	Reads a set value.	Supported	Supported
01	02	Write to variable area	Writes a set value.	Supported	Supported
01	04	Composite read from variable area	Reads more than one non-consecutive set value.	Supported	Supported
01	13	Composite write to variable area	Writes more than one non-consecutive set value.	Supported	Supported
01	10	Composite registration read	Reads in order the contents of addresses specified for composite read registration of set values.	Supported	Supported
01	11	Composite read registration	Specifies the addresses to be read for a composite read of set values.	Supported	Supported
01	12	Composite read registration confirmation	Reads the contents of the registration for composite read of set values.	Supported	Supported
05	03	Controller attribute read	Reads the model and communications buffer size.	Supported	Supported
06	01	Controller status read	Reads the operating status.	Supported	Supported
08	01	Echoback test	Performs an echoback test.	Supported	Supported
30	05	Operation commands	Executes RUN/STOP, AT execute/AT cancel, and other operations.	Supported	Supported

Note G3ZA set values can be read from the Basic Unit connected to the G3ZA. The Basic Unit has variables for use with the G3ZA. The G3ZA set values can be read and written by reading and writing these variables.

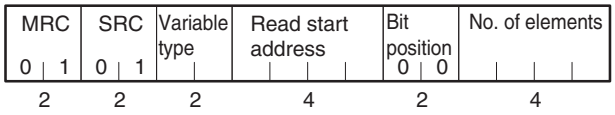
6-4 Detailed Description of Services

6-4-1 Read from Variable Area

This service reads from a variable area.

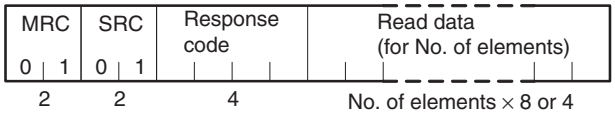
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Variable Type and Read Start Address
   Refer to *Parameter List* on page 235.
2. Bit Position
   The EJ1 does not support bit access. Fixed to 00.
3. No. of Elements

Read data length	No. of elements
For double-word (8-digit) variable type	40 max. (0028H)
For word (4-digit) variable type	80 max. (0050H)

Note The following values apply for the DA/9A variable types.

Read data length	No. of elements
For double-word (8-digit) variable type	25 max. (0019H)
For word (4-digit) variable type	50 max. (0032H)

4. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
110B	Response too long	The number of elements exceeds the maximum.
1100	Parameter error	Bit position is not 00.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

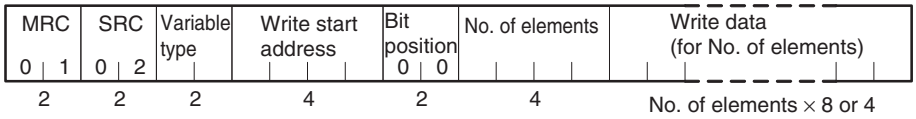
5. Precautions
   - “0” is set when an address with no data set is read.
   - If the start address + number of elements exceeds FFFF, the address returns to 0000.

6-4-2 Write to Variable Area

This service writes to a variable area.

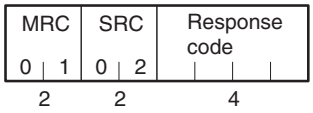
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Variable Type and Write Start Address
   Refer to *Parameter List* on page 235.
2. Bit Position
   The EJ1 does not support bit access. Fixed to 00.
3. No. of Elements

Write data length	No. of elements
For double-word (8-digit) variable type	39 max. (0027H)
For word (4-digit) variable type	79 max. (004FH)

Note The following values apply for the DA/9A variable types.

Write data length	No. of elements
For double-word (8-digit) variable type	24 max. (0018H)
For word (4-digit) variable type	48 max. (0030H)

4. Response Codes

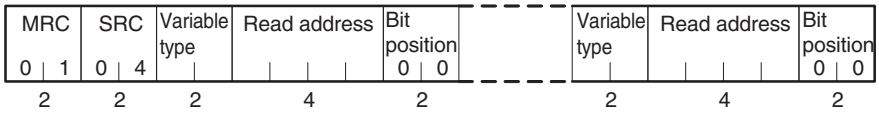
Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1003	Number of elements/ data mismatch	The number of data does not match the number of elements.
1100	Parameter error	Bit position is not 00.Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
3003	Read-only error	An attempt was made to write to a read-only variable.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

6-4-3 Composite Read from Variable Area

This service reads in order the contents of specified addresses in a variable area.

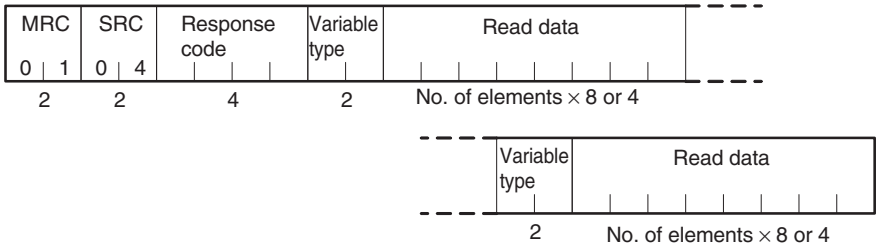
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



The read data is read together with the variable type, in the order specified in the command.

1. Variable Type and Read Address

   Refer to *Parameter List* on page 235.
   Composite reads cannot be performed for the DA/9A variable types.

2. Bit Position

   The EJ1 does not support bit access. Fixed to 00.

3. Response Codes

Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
110B	Response too long	The number of elements exceeds the maximum.
1100	Parameter error	Bit position is not 00.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

4. No. of Read Data Items (Variable Type + Read Data)

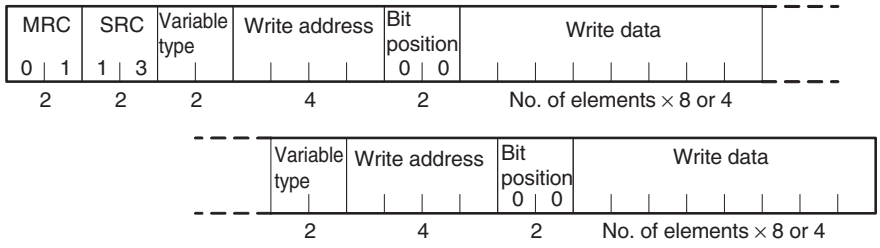
Read data length	No. of read data items
For double-word (8-digit) variable type	32 max. (0020H)
For word (4-digit) variable type	41 max. (0029H)

6-4-4 Composite Write to Variable Area

This service writes in order the contents of specified addresses to a variable area.

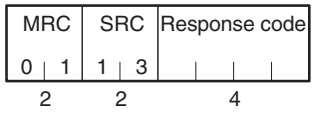
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Variable Type and Write Address

   Refer to *Parameter List* on page 235.
   Composite writes cannot be performed for the DA/9A variable types.

2. Bit Position

   The EJ1 does not support bit access. Fixed to 00.

3. No. of Write Data Items

Write data length	No. of write data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	27 max. (001BH)

4. Response Codes

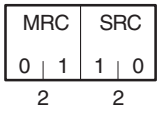
Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1100	Parameter error	Bit position is not 00. Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
3003	Read-only error	An attempt was made to write to a read-only variable type.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

6-4-5 Composite Registration Read

This service reads in order the contents of addresses specified in a variable area composite read registration.

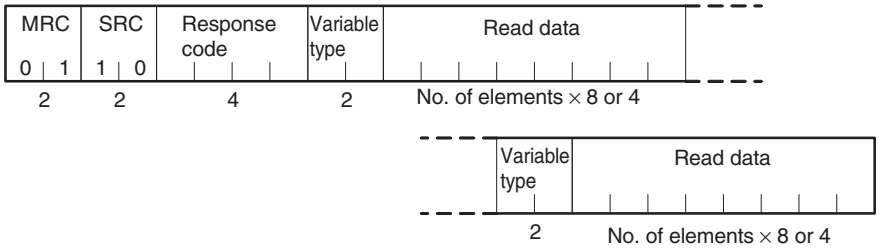
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
110B	Response too long	The number of elements exceeds the maximum.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

2. Variable Type

Refer to *Parameter List* on page 235.

3. No. of Read Data Items

Read data length	No. of read data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

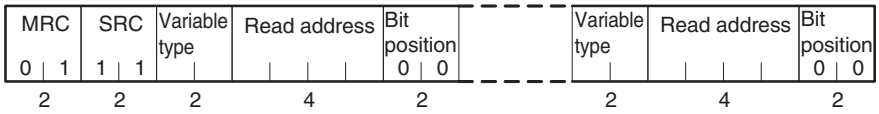
6-4-6 Composite Read Registration

This service specifies the addresses to be read when using the composite read registration from variable area service.

The registered data is saved in EEPROM.

■ **Command**

Service Request PDU



■ **Response**

Service Response PDU

1. Variable Type and Read Address

   Refer to *Parameter List* on page 235.
   Composite reads/writes cannot be registered for the DA/9A variable types.

2. Bit Position

   The EJ1 does not support bit access. Fixed to 00.

3. No. of Registered Data Items (Variable Type + Read Address + Bit Position)

Registered data length	No. of registered data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

4. Response Codes

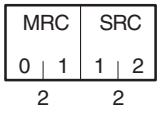
Response code	Error name	Cause
1002	Command too short	The command is not long enough.
1101	Area type error	The corresponding variable type does not exist.
1100	Parameter error	Bit position is not 00. Write data is out of setting range.
2201	Operation error (2201)	The command cannot be executed during operation.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received.
7014	Operation error (7014)	The command cannot be executed during backup.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

6-4-7 Composite Read Registration Confirmation

This service reads the contents of the registration for a composite read from a variable area.

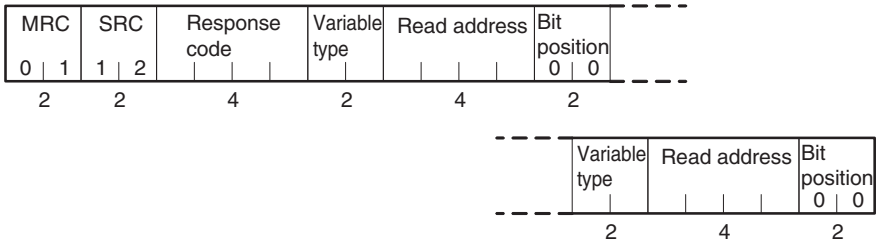
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
7011	Operation error (7011)	The command cannot be executed due to a device error.
0000	Normal completion	Processing was completed normally.

2. Variable Type and Read Address

   Refer to *Parameter List* on page 235.

3. Bit Position

   The EJ1 does not support bit access. Fixed to 00.

4. No. of Registered Data Items (Variable Type + Read Address + Bit Position)

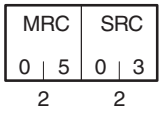
Registered data length	No. of registered data items
For double-word (8-digit) variable type	20 max. (0014H)
For word (4-digit) variable type	

6-4-8 Controller Attribute Read

This service reads the model number and communications buffer size.

■ **Command**

Service Request PDU



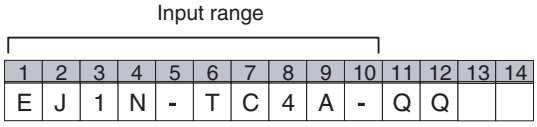
■ **Response**

Service Response PDU

1. Model

   From 1 to 10 in *1-2-3 Model Number Legend* can be read.

   Example:



2. Buffer Size

   The communications buffer size is expressed in 2-byte hexadecimal, and read after being converted to 4-byte ASCII.

   The buffer size is the smaller of the send and receive buffer sizes.

3. Response Codes

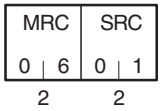
Response code	Error name	Cause
1001	Command too long	The command is too long.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7015	Operation error (7015)	The command cannot be executed while resetting (including during start-up).
0000	Normal completion	Processing was completed normally.

6-4-9 Controller Status Read

This service reads the operating status and error status.

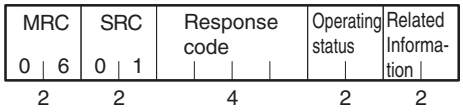
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Operating Status
   - TC4/TC2

Channel	Bit position	Meaning
CH1	0	00: Operating 01: Error output 10: Stopped 11: In manual operation
	1	
CH2	2	
	3	
CH3	4	
	5	
CH4	6	
	7	

   - HFU
     Fixed to 00.

2. Related Status

Code	HFU	TC4 and TC2
00	Startup processing	Startup processing
01	Device failure	Device failure
02	Device error	Device error
03	Configuration confirmation	Configuration confirmation
04	Configuration error	Configuration error
05	Normal	---
06	---	Normal

3. Response Codes

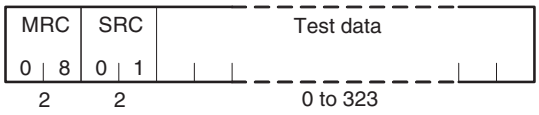
Response code	Error name	Cause
1001	Command too long	The command is too long.
0000	Normal completion	Processing was completed normally.

6-4-10 Echoback Test

This service performs an echoback test.

■ **Command**

Service Request PDU



■ **Response**

Service Response PDU

1. Test Data

   Up to 323 (0143H).
   The test data must be within the following ranges depending on the communications data length.

Communications data length	Test data
8 bits	ASCII H'20 to H'7E and H'A1 to H'FE
7 bits	ASCII H'20 to H'7E

2. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
0000	Normal completion	Processing was completed normally.

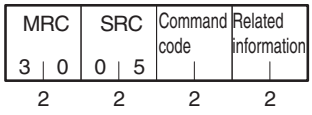
6-4-11 Operation Commands

The following parameter settings are made using operation commands.

- Write Mode
- Software Reset
- Run
- Stop
- Manual
- Automatic
- AT Execute
- AT Cancel
- Bank 0 Change to Bank 3 Change
- LSP Change
- RSP Change
- Reset Error
- Alarm 1 to Alarm 3 Latch Cancel
- All Alarm Latch Cancel
- Save RAM Data
- Parameter Initialization
- Save RAM Data 2
- Register Unit Configuration

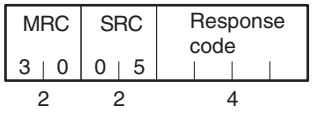
■ **Command**

Service Request PDU



■ **Response**

Service Response PDU



1. Command Code by Unit and Related Information

	Command code	TC related information	HFU related information
Write Mode	04	00: Backup 01: RAM	
Software Reset	06	Always 00.	
Run	0A	00 to 03: Channel FF: All channels	---
Stop	0B		
Manual	0C		
Auto	0D		
40% AT Execute	0E		
100% AT Execute	0F		
AT Cancel	10		
Bank 0 Change	1E		
Bank 1 Change	1F		
Bank 2 Change	20		
Bank 3 Change	21		
Local SP Change	22		
Remote SP Change	23		
Reset Error	2D	Always 00.	---
Alarm 1 Latch Cancel	32	00 to 03: Channel FF: All channels	
Alarm 2 Latch Cancel	33		
Alarm 3 Latch Cancel	34		
All Alarm Latch Cancel	35		
Save RAM Data (See note 1.)	37	Always FF.	
Parameter Initialization	38	Always 00.	
Save RAM Data 2 (See note 2.)	39	Always FF.	
Register Unit Configuration	3B	00: Reset 01: Register	

Note (1) Set values that can be changed during operation are saved to EEPROM.
(2) All set values are saved to EEPROM.

■ Description of Operation Commands and Precautions

- Write Mode
  Set either the Port B backup mode or RAM write mode using the related information. (The default is RAM write mode.)
  When the mode is switched from RAM write mode to backup mode, the settings for the parameters that can be changed during operation are not written to EEPROM. Execute the Save RAM Data command if required.

Note Settings that are changed from port A are always written to EEPROM. Be sure to consider the limit to the number of writes when using port A.

- Software Reset
  Executes a software reset.
  A software reset performs the same operation as when the power is cycled.
  Execute a software reset only when control operations are stopped for all channels.
- RUN/STOP
  Starts or stops operation for the channels specified in the related information.
- Auto/manual Switch
  Switches between manual mode and automatic mode for the channels specified in the related information. When switching from automatic to manual mode, the MV will be written to EEPROM.
  An operation error is generated in the following instances:
  - ON/OFF control
    A Normal End is returned when Automatic Mode is executed when already in automatic mode or Manual Mode is executed when already in manual mode.
  - Switching to Manual Mode during Execution of AT (or ST with **V1.2**).
    If AT (or ST when using **V1.2**) is being executed, AT (or ST with **V1.2**) is canceled and the mode is switched to manual mode.
- 40% AT Execute/Cancel and 100% AT Execute/Cancel
  Selects executing or canceling autotuning for the channels specified in the related information. An “operation error” is generated in the following instances:
  - When the “run/stop” parameter is set to “stop.”
  - When the “auto/manual” parameter is set to “manual.”
  - During ON/OFF control.
  - When 100% AT Execute is specified during 40% AT Execute execution.
  - When 40% AT Execute is specified during 100% AT Execute execution.
- Bank 0 Change to Bank 3 Change
  Switches between banks 0 to 3. Refer to *4-7-1 Bank Function* for details on banks.
  An operation error will occur if autotuning is already being performed for a specified channel.

- LSP Change and RSP Change
  Sets SP Mode (LSP (local SP)/RSP (remote SP).
  An operation error will occur if autotuning is already being performed for a specified channel.
- Reset Error
  Clears the following errors: heater burnout latch, HS alarm latch, heater overcurrent latch, heater overcurrent, and operation during error (selection B).
- Alarm Latch Cancel
  Cancels alarm latches. This command is enabled when the alarm latch function is used.
- Save RAM Data
  Writes the settings for parameters that can be changed during operation to EEPROM.
- Parameter Initialization
  Returns the current set values to their default values. The setting is not saved to EEPROM, however, so Save RAM Data 2 should be executed if required.
  Execute Save RAM Data 2 only when control operations are stopped for all channels.
- Save RAM Data 2
  Writes settings (except read-only settings) to EEPROM.
  Execute Save RAM Data 2 only when control operations are stopped for all channels.
- Register Unit Configuration
  Registers or resets the G3ZA Unit Configuration. Refer to *4-7-4 Using G3ZA Multi-channel Power Controllers* for details on Unit configuration registration.
  Execute Save RAM Data 2 only when control operations are stopped for all channels.

2. Response Codes

Response code	Error name	Cause
1001	Command too long	The command is too long.
1002	Command too short	The command is not long enough.
1100	Parameter error	The command code or related information is wrong.
0402	Operation error (0402)	The command cannot be executed because the model or version is not the same.
2201	Operation error (2201)	The command cannot be executed during operation.
2202	Operation error (2202)	The command cannot be executed because operation is stopped.
2203	Operation error (2203)	• The command cannot be executed in normal mode. • The command cannot be executed in manufacturer mode.
7011	Operation error (7011)	The command cannot be executed due to a device error.
7012	Operation error (7012)	The command cannot be executed due to a configuration error.
7013	Operation error (7013)	The command cannot be executed because the operation command cannot be received. Execute retries until the 7013 response code is reset.

Response code	Error name	Cause
7014	Operation error (7014)	The command cannot be executed because EEPROM is currently being written. Execute retries until the 7014 response code is reset.
7015	Operation error (7015)	The command cannot be executed during reset (including startup).
7016	Operation error (7016)	The command cannot be executed during error latch status.
7020	Operation error (7020)	The command cannot be executed in the current control mode.
7021	Operation error (7021)	The command cannot be executed because the control switching conditions have not been established.
7030	Operation error (7030)	The command cannot be executed in the current output mode.
7041	Operation error (7041)	The command cannot be executed in manual operation mode.
7042	Operation error (7042)	The command cannot be executed in tuning mode.
0000	Normal completion	Processing was completed normally.

SECTION 7
Modbus Communications V1.1

This section describes how to use Modbus communications based on communications commands.

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7-1 Communications Settings

Communications are programmed on the host computer. Descriptions of communications in this manual are therefore written from the viewpoint of the host computer. For example, references to reading and writing mean reading data from the EJ1 to the host computer and writing data from the host computer to the EJ1.

The EJ1 uses different communications specifications from existing products to improve communications operability.

Parameter Validity

The conditions for parameter validity that depended on the model and setting status no longer apply.

Fixed Values for Setting Ranges

For example, the setting range for the target value is fixed to −1,999 to 9,999, regardless of the input type. In other words, the setting ranges under the new specifications will not change based on the input type or related parameters.

For parameters that set ranges with upper and lower limits, the specifications now allow the upper and lower limits to be reversed.

Refer to *4-1-3 Analog Inputs, 4-3-4 Setting the Set Point, and MV Limiter* on page 77 *in Section 4 Basic Units (TC4/TC2)* before using the EJ1.

Automatic Offsetting of Setting Values

Accompanying changes outlined under *Fixed Values for Setting Ranges* above, there are no longer any restrictions in operations for the target value limiter or target values for changes in the input type. Under the new specifications, there is also no need to change control output assignments when operations, such as selecting heating and cooling, are performed.

Refer to *4-2-1 Control Output Assignments, Heating/Cooling Control* on page 69*, and 4-3-4 Setting the Set Point in Section 4 Basic Units (TC4/TC2)* before using the EJ1.

7-1-1 Communications Specifications

Parameter name	Settings
	EDU (Port B)
Transmission path connection	Multipoint
Communications	RS-485
Synchronization method	Start-stop synchronization
Transmission code	RTU (Remote Terminal Unit)
Error detection	CRC-16 (Cyclical Redundancy Check)
Flow control	None
Retry function	None

EDU (Port B)

The following communications settings are used.

Parameter name	Setting range	Default	Setting method
Unit number	00 to 63	01	SW1/SW2
Port B communications protocol	0: CompoWay/F 1: Modbus	0: CompoWay/F	Communications or SW2 **V1.2**
Port B communications baud rate	3: 9.6 4:19.2 5: 38.4 6: 57.6 7: 115.2 (kbps)	3: 9.6 (kbps)	Communications or SW2 **V1.2**

Parameter name	Setting range	Default	Setting method
Port B communications parity	0: None 1: Even 2: Odd (bit)	1: Even (bit)	Communications
Port B send data wait time	0 to 99 (ms)	5 (ms)	Communications

Note

(1) Always set the port B communications protocol to Modbus (1). With version **V1.2**, if No. 3 of SW2 is ON when the power is turned ON, the protocol is set to Modbus regardless of the port B communications protocol setting.

(2) The port B communications data length and port B communications stop bits settings do not need to be changed.
When using an Interface Converter (e.g., K3SC), set the communications data length for the Interface Converter to 8 bits, and set the communications stop bits according to the following.
If the port B communications parity is 0: None, then set the communications stop bits to 2 bits.
If the port B communications parity is 1: Even, or 2: Odd, then set the communications stop bits to 1 bit.

7-1-2 Unit Number Setting

The unit number is set first. The setting is made on SW1 and SW2 on the front of the EJ1. For information on the setting method, refer to *1-1-4 Using Setting Switches*.

7-1-3 Other Communications Settings

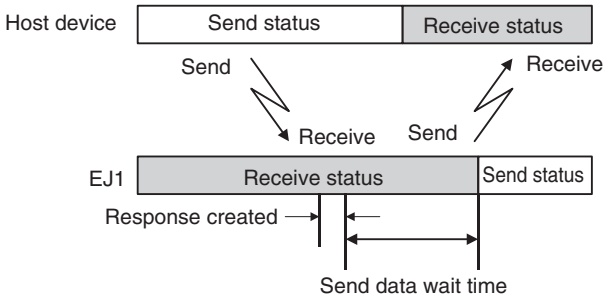
The communications protocol, communications band rate, communications data length, communications parity, and send data wait time are set using the CX-Thermo Support Software.

When the above settings are changed, the changes will not be enabled until the EJ1 is reset or the power is cycled.

With V1.2, the communications protocol and baud rate can be set on switch SW2. Refer to *Setting Switch 2 (SW2) Settings* on page 4 for the setting procedure. **V1.2**

7-1-4 Send Data Wait Time

The send data wait time setting is used to adjust the time the host computer takes to switch from sending to receiving. Specifically, the send data wait time for the EJ1 is the time from after a response has been created after data has been received until the EJ1 switches to sending.



The setting of the Send Wait Time parameter can be shortened to reduce the communications time at the host device as long as there are no problems.

7-2 Frames

Commands from the host computer and responses from the EJ1 take the form of frames that conform to the Modbus (RTU) protocol. The data included in command frames and response frames is described in this section.

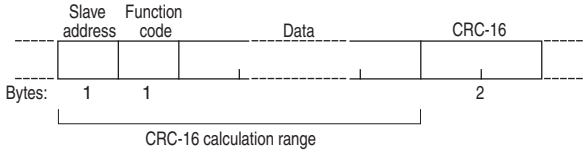
In the following descriptions, an “H” before a numeric value (for example H’02) indicates that the value is a hexadecimal number. Numbers or letters enclosed in quotation marks (for example “00”) are ASCII characters.

Modbus Communications Protocol

Modbus is a communications control method that conforms to the RTU Mode of the Modbus protocol (specifications PI-MBUS-300 Rev. J) of Modicon Inc. Refer to the OMRON specifications for detailed specifications of the Modbus protocol.

7-2-1 Command Frames

In RTU Mode, each frame begins and ends with a silent time interval that is at least 3.5 characters long.



	Silent interval at least 3.5 characters long.
Slave address	Specify the unit number of the EJ1 between H'00 and H'3F (0 to 63). When broadcasting to all nodes, specify H'00. Responses are not returned for broadcasts.
Function code	The function code specifies the command from the host computer. The code is set in hexadecimal and is 1 byte long. For more information, refer to *7-3 Function Codes*.
Data	The text of command based on the function code. Specifies variable addresses and the values for set values in hexadecimal.
CRC-16	Cyclical Redundancy Check These two bytes store check code calculated from the slave address to the end of the data in hexadecimal.
	Silent interval at least 3.5 characters long.

Example of CRC-16 Calculation

A message is processed 1 byte at a time in a 16-bit processing register called the CRC register.

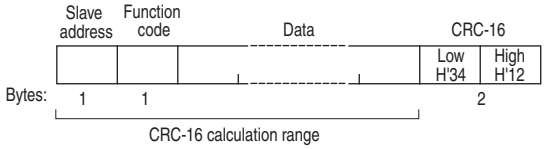
1,2,3...

1. An initial value of H'FFFF is set in the CRC register.
2. An XOR is taken of the contents of the CRC register and the 1st byte of the message, and the result is returned to the CRC register.
3. The contents of the CRC register is shifted 1 bit to the right, and 0 is placed in the MSB.
4. If the bit shifted from the LSB is 0, step 3 is repeated (i.e., the contents of the register is shifted 1 more bit).
   If the bit shifted from the LSB is 1, an XOR is taken of the contents of the CRC register and H'A001, and the result is returned to the CRC register.
5. Steps 3 and 4 are repeated until the contents of the register have been shifted 8 bits to the right.
6. If the end of the message has not been reached, an XOR is taken of the next byte of the CRC register and the message, the result is returned to the CRC register, and the procedure is repeated from step (3).

7. The result (the value in the CRC register) is placed in the lower byte of the message.

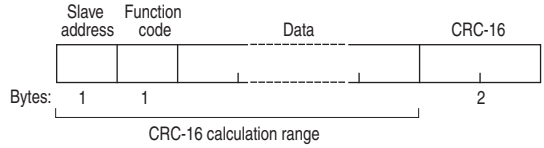
   Example of Appending the Result

   If the calculated CRC value is H'1234, this is appended as follows to the command frame:

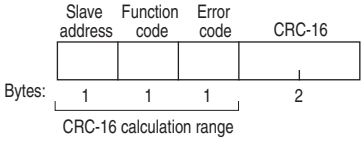


7-2-2 Response Frames

Normal Response Frames



Error Response Frames



Slave address	The unit number that was specified in the command frame is returned here. This is the unit number of the responding EJ1.
Function code	The function code that was received is returned here. In an error response frame, “H'80” is added to the value to indicate that this is an error response. Example: Received function code = H'03 Function code in error response frame = H'83
Error code	An end code that indicates the error.
CRC-16	Cyclical Redundancy Check These two bytes are a check code calculated from the slave address through the end of the data in hexadecimal.

No Response

In the following cases, the received command is not processed and a response is not returned. A timeout will occur at the host device.

- The slave address in the received command is different from the communications unit number set in the EJ1.
- A parity error, framing error, or overrun error occurred due to a transfer error or other error.
- A CRC-16 code error occurred in the received command frame.
- A time interval greater that 3.5 characters occurred between data while receiving a command frame.

In the following case, the command is processed, but a response is not returned.

- Broadcast transmission (Slave address: H’00)

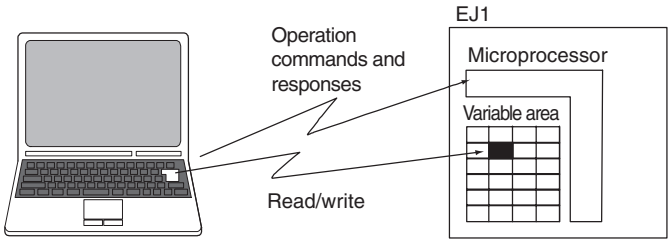
7-3 Function Codes

Function code	Name	Description
03 (H'03)	Multiple Read from Variable Area	Reads from a variable area. Multiple variables that are consecutive can be read.
16 (H'10)	Multiple Write to Variable Area	Writes to a variable area. Multiple variables that are consecutive can be written. Broadcasting is possible.
06 (H'06)	Single Write to Variable Area	Writes to a variable area or an operation command. Broadcasting is possible.
08 (H'08)	Echoback Test	Performs an echoback test.

7-4 Variable Areas

The areas used for data exchange when communicating with the EJ1 are called the variable areas. Present values can be read, and set values can be read and written using the variable areas.

Operation commands do not use the variable areas.



7-4-1 Addresses

Refer to *Parameter List* on page 235 for parameter addresses. Parameters with the following variable types can be used with the Modbus protocol: C4 (84), C5 (85), and D0 (90) to D6 (96).

7-4-2 Number of Elements

The number of elements is expressed in 2-byte hexadecimal format.

The range for specifying the number of elements differs for each command. Refer to *7-5 Detailed Description of Services*.

7-4-3 Communications Data

Setting (monitor) value	Communications data (See note.)	Negative values	Decimal point
Hexadecimal	2 bytes	2's complement	The decimal point is removed and the result is converted to hexadecimal. Example: 105.0 → 1050 → 041A

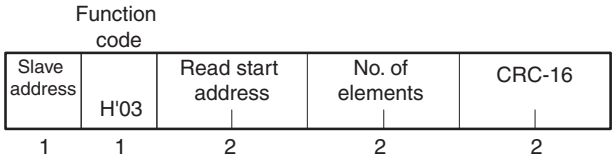
Note Refer to *Parameter List* on page 235.

7-5 Detailed Description of Services

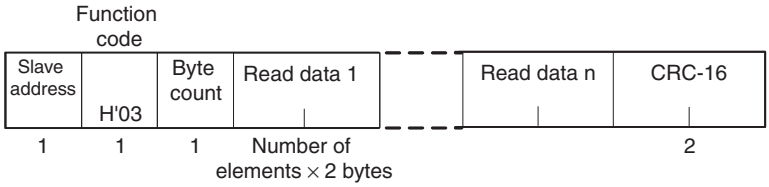
7-5-1 Multiple Read from Variable Area

This service reads data from the variable area.

Command



Response



1. Read Start Address

   Refer to *Parameter List* on page 235.

2. No. of Elements

   Specify the number of elements to read. The specification range is from H'0001 to H'0050 (1 to 80 elements).

3. Byte Count

   The number of bytes of data that was read is returned.

4. Response Codes

Function code	Error code	Error name	Cause
H'83	H'01	Function code error	A function code that is not supported was specified.
	H'02	Variable address error	The read start address is not correct.
	H'03	Variable data error	• The command is too long. • The command is not long enough. • The number of elements has exceeded the maximum limit.
H'03	---	Normal end	The service was processed normally.

Command/Response Example

The following command reads the process value of channel 1.

Slave address: H'01

Read start address: H'0200

Read data: H'03E8 (when the process value is 100.0°C)

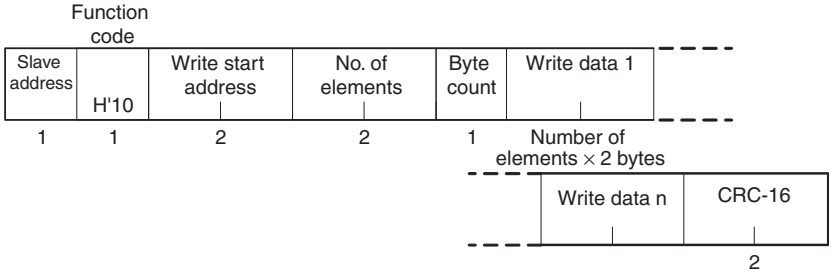
Command: 01 03 0200 0001 85B2 (CRC-16)

Response: 01 03 02 03E8 B8FA (CRC-16)

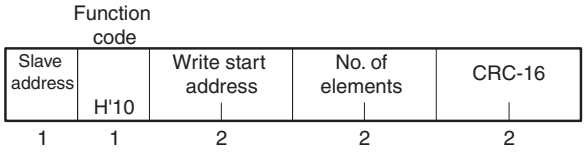
7-5-2 Multiple Write to Variable Area

This service writes data to the variable area.

Command



Response



1,2,3... 1. Write Start Address

Refer to *Parameter List* on page 235.

2. No. of Elements

Specify the number of elements to write. The specification range is from H'0001 to H'007F (1 to 127 elements).

3. Byte Count

Specify the number of bytes of write data. Each data element is two bytes, so specify two times the number of elements.

4. Response Codes

Function code	Error code	Error name	Cause
H'90	H'01	Function code error	A function code that is not supported was specified.
	H'02	Variable address error	The write start address is not correct.
	H'03	Variable data error	• The command is not long enough. • The number of elements and number of data items do not agree. • The number of elements times two does not agree with byte count. • The write data exceeded the setting range. • An attempt was made to write to a read-only variable type.
	H'04	Operation error	• The command cannot be executed because the operation command cannot be received. • The command cannot be executed during backup. • The command cannot be executed during reset (including startup). • The command cannot be executed in tuning mode.
H'10	---	Normal end	The service was processed normally.

Command/Response Example

The following command writes the set point of channel 1.

Slave address: H'01

Write start address: H'0240

Write data: H'03E8 (to write a set point of 100.0°C)

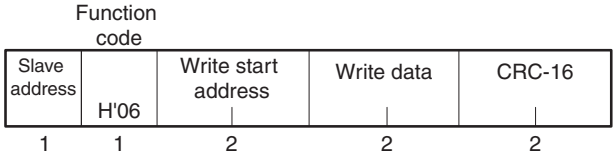
Command: 01 10 0240 0001 02 03E8 8BEE (CRC-16)

Response: 01 10 0240 0001 01A5 (CRC-16)

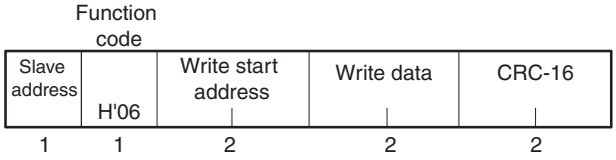
7-5-3 Single Write to Variable Area

This service either writes data to the variable area or executes one of the operation commands given in the table in *2. Write Data*, below.

Command



Response



1. Write Start Address

   Set the write start address to H'FFFF (or H'0000 when using version **V1.2**) when executing an operation command. When writing to the variable area, refer to *Parameter List* on page 235.

2. Write Data

   When executing an operation command, place the command code in the upper byte of the write data and place the related information in the lower byte. When writing data to the variable area, refer to *Parameter List* on page 235.

Operation command	Command code	TC related information
Write Mode	04	00: Backup 01: RAM
Software Reset	06	Always 00.

Operation command	Command code	TC related information
RUN	0A	00: Channel 1 01: Channel 2 02: Channel 3 03: Channel 4 FF: All channels
STOP	0B	
Manual	0C	
Auto	0D	
40% AT Execute	0E	
100% AT Execute	0F	
AT Cancel	10	
Bank 0 Change	1E	
Bank 1 Change	1F	
Bank 2 Change	20	
Bank 3 Change	21	
Local SP Change	22	
Remote SP Change	23	
Reset Error	2D	Always 00.
Alarm 1 Latch Cancel	32	00: Channel 1 01: Channel 2 02: Channel 3 03: Channel 4 FF: All channels
Alarm 2 Latch Cancel	33	
Alarm 3 Latch Cancel	34	
All Alarm Latch Cancel	35	
Save RAM Data (See note 1.)	37	Always FF.
Set value initialization (See note 2.) **V1.2**	38	Always 00
Save RAM Data 2 (See note 3.) **V1.2**	39	Always FF
Register Unit Configuration	3B	00: Reset 01: Register

Note

(1) Set values that can be changed during operation are saved to EEPROM.

- Descriptions of and Precautions for Operation Commands
  Refer to *Description of Operation Commands and Precautions* on page 187

(2) Performing set value initialization will initialize the port B communications protocol to 0: CompoWay/F. If you do not want to change the protocol, turn ON No. 3 of SW2. The protocol will be set to Modbus regardless of the port B communications protocol setting.

(3) All set values are saved in non-volatile memory (EEPROM).

3. Response Codes

The following response codes are for operation commands. For the response codes for writing to the variable area, refer to the response codes under *7-5-2 Multiple Write to Variable Area*.

Function code	Error code	Error name	Cause
H'86	H'01	Function code error	A function code that is not supported was specified.
	H'03	Variable data error	• The command is too long. • The command is not long enough. • The command code does not match the related information in the write data.
	H'04	Operation error	• The command cannot be executed because the model or version is not the same. • The command cannot be executed because operation is stopped. • The command cannot be executed during operation. • The command cannot be executed due to a configuration error. • The command cannot be executed because the operation command cannot be received. • The command cannot be executed because EEPROM is currently being written. • The command cannot be executed during reset (including startup). • The command cannot be executed during error latch status. • The command cannot be executed in the current control mode. • The command cannot be executed in the current output mode. • The command cannot be executed in manual operation mode. • The command cannot be executed in tuning mode.
H'06	---	Normal end	The service was processed normally.

Command/Response Example

The following command executes the RUN operation command for channel 1.

Slave address: H'01

Write data: H'0A00 (0A: Operation command (RUN),
00: Related information (channel 1))

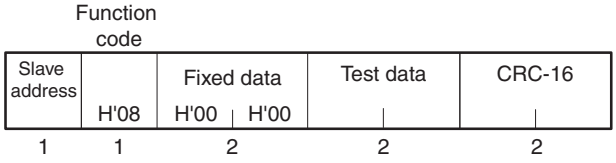
Command: 01 06 FFFF 0A00 8F4E (CRC-16)

Response: 01 06 FFFF 0A00 8F4E (CRC-16)

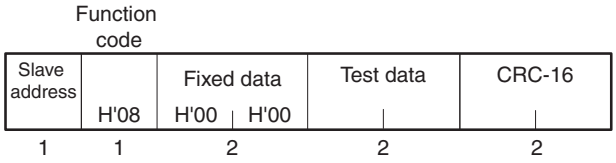
7-5-4 Echoback Test

This service executes an echoback test.

Command



Response



1. Test Data

   Any data in 2-byte hexadecimal format.

2. Response Codes

Function code	Error code	Error name	Cause
H'88	H'01	Function code error	A function code that is not supported was specified.
	H'03	Variable data error	• The command is too long. • The command is not long enough. • The fixed data was not H'0000.
H'08	---	Normal end	The service was processed normally.

Command/Response Example

Slave address: H'01

Test data: H'1234

Command: 01 08 0000 1234 ED7C (CRC-16)

Response: 01 08 0000 1234 ED7C (CRC-16)

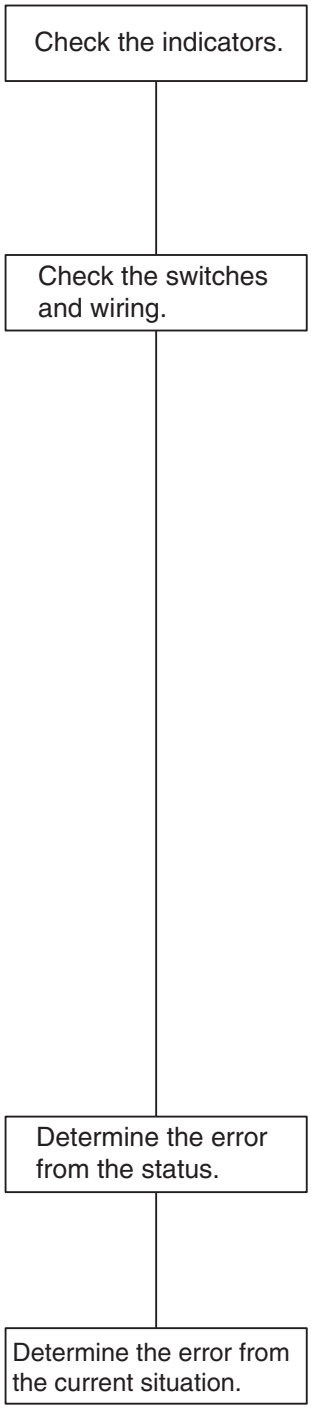
SECTION 8
Errors and Error Processing

This section describes methods for checking possible problems in operation depending on classifications of Temperature Controller status.

8-1 Things to Check First 206
8-2 Determining Errors from Indicators 207
8-3 Determining the Error from the Status 209
8-3 Determining the Error from the Status 209
8-4 Determining the Error from the Current Situation for Communications Errors 214
8-5 Determining the Error from the Current Situation for Temperature Measurement Errors 223
8-6 Determining the Error from the Current Situation for Temperature Control Errors 224
8-7 Determining the Error from the Current Situation for Output Errors 226
8-8 Determining the Error from the Current Situation for Heater Burnout Alarm Errors 227

8-1 Things to Check First

If an error occurs, check the following items and take corrective measures if required.


Check the indicators.
Check the switches and wiring.
Determine the error from the status.
Determine the error from the current situation.

Check the EJ1 operating status by looking at the indicators.

If the ERR indicator is lit, cycle the EJ1 power supply. If the ERR indicator does not light when power comes back ON, check for noise as the cause of the error and take countermeasures.

With a version **V1.2** TC4/TC2, when No. 6 of SW2 is turned ON, the operation indicator will display the output status. Always turn OFF No. 6 of SW2 for confirmation.

Check the switch settings and wiring.

- Power Supply
  - Is the power turned ON?
  - Is the power supply voltage within the allowable range?
- Switches
  - Are the switch settings correct for the system being used?
- Wiring
  - Is the terminal block correctly wired?
  - Is the polarity correct?
  - Are any wires disconnected?
  - Are any wires or cables broken or touching?
- Communications Conditions
  - Do the communications conditions match those of the host system?

If none of these check items needs correction or the error is not cleared even after performing the above checks, use the communications function to investigate in more detail.

Check the EJ1 status. Find the cause of the error based on the data read by the EJ1, then correct the error.

If the cause of the error is still not clear after checking all these items, infer the cause from the current situation and try countermeasures.

8-2 Determining Errors from Indicators

The following table shows indicator status, possible error causes, and countermeasures.

With a version **V1.2** TC4/TC2, when No. 6 of SW2 is turned ON, the operation indicator will display the output status. Always turn OFF No. 6 of SW2 for confirmation.

Status			Possible causes	Countermeasure
PWR	■	Not lit	There is no power supply.	Check to see if the Units are linked properly.
RUN	■	Not lit	The power supply voltage is outside the allowable range.	Adjust the voltage to within the range.
ERR	■	Not lit	The Unit is malfunctioning.	Replace the Unit.
ALM	■	Not lit		
PWR	◪	Green, flashing 0.5 s	The Unit is malfunctioning.	Cycle the power supply. If the problem persists, replace the Unit.
RUN	—	---		
ERR	□	Red, lit		
ALM	—	---		
PWR	◪	Green, flashing 1 s	The settings data is corrupted.	Send the Parameter Initialization operation command to initialize the parameters and then set them again.
RUN	■	Not lit	The Unit configuration information is corrupted (Basic Units only).	Send the Register Unit Configuration: Reset operation command and then cycle the EJ1 power supply.
ERR	□	Red, lit	The Unit is malfunctioning.	Replace the Unit.
ALM	—	---		
PWR	□	Green, lit	A Unit is not connected correctly.	Check Unit models and the order of connection.
RUN	■	Not lit	The registered Unit configuration does not match the actual Unit configuration (Basic Units only).	Restore the registered Unit configuration or re-register the configuration.
ERR	□	Red, lit	The same unit number is set for more than one connected G3ZA (Basic Units only).	Correct the G3ZA unit number settings and then cycle the power supply.
ALM	■	Not lit	There is an error in a connected G3ZA (Basic Units only).	Refer to the *G3ZA User's Manual* (Cat. No. Z200) and take the required countermeasures.

In addition to the above, the status of the following indicators can be used to determine the cause of and countermeasures for errors.

TC4/TC2

Status			Possible causes	Countermeasure
RUN	◪	Green, flashing	There is an error in a channel that is currently running.	Read status to determine the channel that has an error and then determine the cause from the status of the ERR and ALM indicators.

Status			Possible causes	Countermeasure
ERR	◪	Red, flashing	There is an input error or a remote SP input error.	Check the wiring for the input or remote SP input to be sure it is wired correctly, not broken, and not shorted. Also check the input type.
			An error has occurred for which the Operation During Error (Selection B) parameter is set to *MV at PV Error* or *Stop control.*	Read status to determine the nature of the error and take appropriate measures.
			An error has occurred in communications with a connected G3ZA.	Check the connection to the G3ZA and take appropriate measures.
ALM	□	Red, lit	One of the following alarms has occurred: heater burnout alarm, heater short alarm, or heater overcurrent alarm.	Read the Error Channel A Status, the Channel Status, and the Channel Alarm Status to determine the channel with the alarm and the nature of the alarm, and take appropriate measures.

HFU

Status			Possible causes	Countermeasure
ALM	□	Red, lit	The power supply to the PLC was interrupted after communications were established between the PLC and EJ1.	Supply power to the PLC. If the Operation Command Response Bits in the Programless Upload Area set in PLC memory are EEEE, write FFFF to the Operation Command Request Bits to restart communications.
			The communications cable was broken after communications were established between the PLC and EJ1.	Connect the cable. If the Operation Command Response Bits in the Programless Upload Area set in PLC memory are EEEE, write FFFF to the Operation Command Request Bits to restart communications.
			Parameters for a Unit that does not exist were registered in the Programless Upload Settings or Programless Download Settings of the HFU.	Register parameters in the Programless Upload Settings or Programless Download Settings of the HFU only for Units that are connected.
			An error has occurred in programless communications.	Check the following and correct any problems, and then restart operation. • Check the communications line lengths (trunk and branch). • Check the communications line for shorts, breaks, or looseness. • Check that terminating resistance is set only on the ends on the trunk line. • Check for excessive noise.
			An illegal operation command code was written to the programless download area in the PLC.	Correct the operation code in the ladder program in the PLC.

8-3 Determining the Error from the Status

The EJ1 status can be checked by using communications to read the Status.

Status is connected to other status data in a directory tree, so the cause of the error can be checked or the channels for which there are alarms can be investigated by searching through the directory tree for the related status.

■ Example of Using Status Information for Troubleshooting

1. Read the Device A Status (C40000) for the TC4 Unit.
   C40000: 'H0004 (i.e., bit 2 is ON)
   → A channel error status bit is ON.
2. Read Error Channel A Status (C4000B).
   C4000B: 'H0008 (i.e., bit 3 is ON).
   → An error or alarm has occurred for channel 4.
3. Read the Channel Status (C40401) and Channel Alarm Status (C40402) of channel 4.
   C40401: 'H0001 (i.e., bit 0 is ON)
   → Operation is stopped but there is no input error.
   C40402: 'H0003 (i.e., bits 0 and 1 are ON)
   → Channel 4 alarms 1 and 2 are ON.

C4/84 0000

Device A Status		
Bit 0	Device Error	0
Bit 1	Configuration Error	0
Bit 2	Channel Error	1
Bit 3	Not used.	0
Bit 4	Expand Communications Error	0
Bit 5	Not used.	0
Bit 6	Not used.	0
Bit 7	Not used.	0
Bit 8	Not used.	0
Bit 9	Not used.	0
Bit 10	I/O Error	0
Bit 11	Lower-level I/O Error	0
Bit 12	I/O Alarm	0
Bit 13	Lower-level I/O Alarm	0
Bit 14	I/O Notification	0
Bit 15	Not used.	0

C4/84 000B

Error Channel A Status		
Bit 0	CH1	0
Bit 1	CH2	0
Bit 2	CH3	0
Bit 3	CH4	1
Bit 4	Not used.	0
Bit 5	Not used.	0
Bit 6	Not used.	0
Bit 7	Not used.	0
Bit 8	Not used.	0
Bit 9	Not used.	0
Bit 10	Not used.	0
Bit 11	Not used.	0
Bit 12	Not used.	0
Bit 13	Not used.	0
Bit 14	Not used.	0
Bit 15	Not used.	0

C4/84 0401

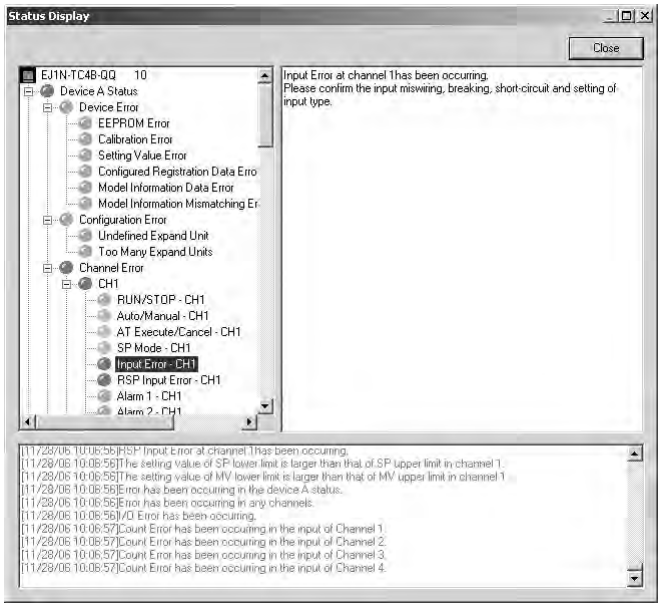
Channel Status		
Bit 0	RUN/STOP	1
Bit 1	Auto/Manual	0
Bit 2	AT Execute/Cancel	0
Bit 3	SP Mode	0
Bit 4	Not used.	0
Bit 5	Not used.	0
Bit 6	Not used.	0
Bit 7	Not used.	0
Bit 8	Input Error	0
Bit 9	RSP Input Error	0
Bit 10	Not used.	0
Bit 11	Not used.	0
Bit 12	Not used.	0
Bit 13	Not used.	0
Bit 14	Not used.	0
Bit 15	Not used.	0

C4/84 0402

Channel Alarm Status		
Bit 0	Alarm 1	1
Bit 1	Alarm 2	1
Bit 2	Alarm 3	0
Bit 3	Not used.	0
Bit 4	Heater Overcurrent	0
Bit 5	HB Alarm	0
Bit 6	HS Alarm	0
Bit 7	OC Alarm	0
Bit 8	Not used.	0
Bit 9	Not used.	0
Bit 10	Not used.	0
Bit 11	Not used.	0
Bit 12	Set Point Limiter Out of Range	0
Bit 13	Set Value Limiter Reverse Operation	0
Bit 14	MV Limiter Reverse Operation	0
Bit 15	Scaling Reverse Operation	0

The CX-Thermo Support Software's Status Display can be used to monitor the EJ1 status and related statuses in a directory tree.

In addition to the status name and details, possible causes of errors and their countermeasures are simultaneously displayed for efficiently processing errors.


Status Display
Close
EJ1N-TC4B-QQ 10
Device A Status
Device Error
EEPROM Error
Calibration Error
Setting Value Error
Configured Registration Data Erro
Model Information Data Error
Model Information Mismatching Er
Configuration Error
Undefined Expand Unit
Too Many Expand Units
Channel Error
CH1
RUN/STOP - CH1
Auto/Manual - CH1
AT Execute/Cancel - CH1
SP Mode - CH1
Input Error - CH1
RSP Input Error - CH1
Alarm 1 - CH1
Alarm 2 - CH1
Input Error at channel 1has been occurring.
Please confirm the input miswiring, breaking, short-circuit and setting of input type.
[11/28/06 10:08:56]Input Error at channel 1has been occurring.
[11/28/06 10:08:56]The setting value of SP lower limit is larger than that of SP upper limit in channel 1.
[11/28/06 10:08:56]The setting value of MV lower limit is larger than that of MV upper limit in channel 1.
[11/28/06 10:08:56]Error has been occurring in the device A status.
[11/28/06 10:08:56]Error has been occurring in any channels.
[11/28/06 10:08:56]I/O Error has been occurring.
[11/28/06 10:08:57]Count Error has been occurring in the input of Channel 1.
[11/28/06 10:08:57]Count Error has been occurring in the input of Channel 2.
[11/28/06 10:08:57]Count Error has been occurring in the input of Channel 3.
[11/28/06 10:08:57]Count Error has been occurring in the input of Channel 4.

Status and Addresses

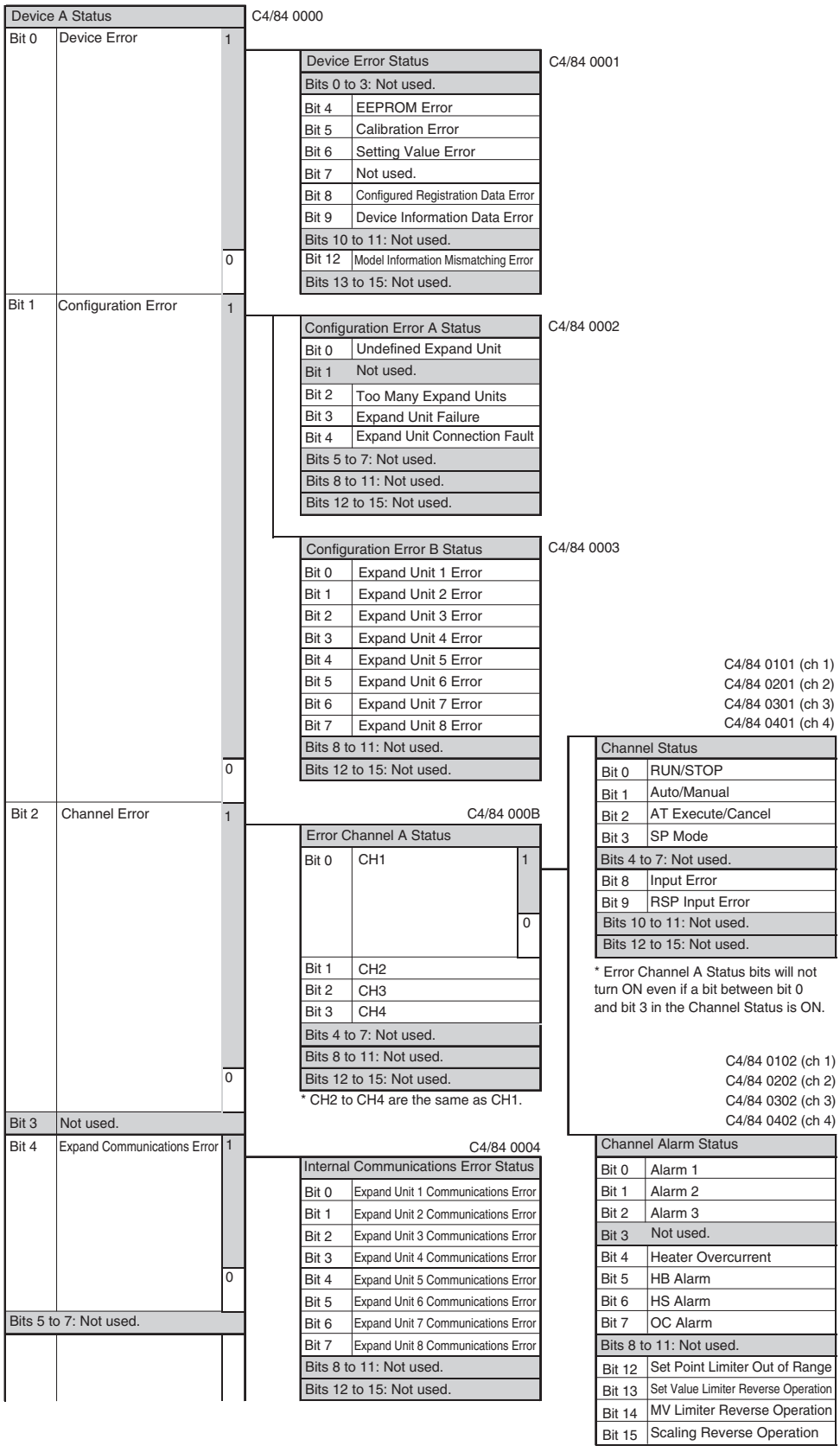
Variable type C4/C84	Parameter name
0000	Device A Status
0001	Device Error Status
0002	Configuration Error A Status
0003	Configuration Error B Status
0004	Internal Communications Error Status
0005	I/O Error Status
0006	I/O Alarm A Status
0007	I/O Alarm B Status
Not used.	
0009	I/O Notification A Status
Not used.	
000B	Error Channel A Status
Not used.	
000F	Basic Unit/Expand Unit Error
0010	Basic Unit/Expand Unit Alarm
Not used.	
0012	Output Status
0013	Device Status B
Not used.	
0020	Version

Variable type C4/C84	Parameter name
Not used.	
0100	Process Value - CH1
0101	Channel Status - CH1
0102	Channel Alarm Status - CH1
0103	Internal Set Point - CH1
	...
0200	Process Value - CH2
0201	Channel Status - CH2
0202	Channel Alarm Status - CH2
0203	Internal Set Point - CH2
	...
0300	Process Value - CH3
0301	Channel Status - CH3
0302	Channel Alarm Status - CH3
0303	Internal Set Point - CH3
	...
0400	Process Value - CH4
0401	Channel Status - CH4
0402	Channel Alarm Status - CH4
0403	Internal Set Point - CH4

Note Refer to *Status Lists* on page 256 for information on bit data and details for individual statuses.

Status Directory Tree

TC4


Device A Status
C4/84 0000
Bit 0 Device Error
1
0
Device Error Status
C4/84 0001
Bits 0 to 3: Not used.
Bit 4 EEPROM Error
Bit 5 Calibration Error
Bit 6 Setting Value Error
Bit 7 Not used.
Bit 8 Configured Registration Data Error
Bit 9 Device Information Data Error
Bits 10 to 11: Not used.
Bit 12 Model Information Mismatching Error
Bits 13 to 15: Not used.
Bit 1 Configuration Error
1
0
Configuration Error A Status
C4/84 0002
Bit 0 Undefined Expand Unit
Bit 1 Not used.
Bit 2 Too Many Expand Units
Bit 3 Expand Unit Failure
Bit 4 Expand Unit Connection Fault
Bits 5 to 7: Not used.
Bits 8 to 11: Not used.
Bits 12 to 15: Not used.
Configuration Error B Status
C4/84 0003
Bit 0 Expand Unit 1 Error
Bit 1 Expand Unit 2 Error
Bit 2 Expand Unit 3 Error
Bit 3 Expand Unit 4 Error
Bit 4 Expand Unit 5 Error
Bit 5 Expand Unit 6 Error
Bit 6 Expand Unit 7 Error
Bit 7 Expand Unit 8 Error
Bits 8 to 11: Not used.
Bits 12 to 15: Not used.
C4/84 0101 (ch 1)
C4/84 0201 (ch 2)
C4/84 0301 (ch 3)
C4/84 0401 (ch 4)
Channel Status
Bit 0 RUN/STOP
Bit 1 Auto/Manual
Bit 2 AT Execute/Cancel
Bit 3 SP Mode
Bits 4 to 7: Not used.
Bit 8 Input Error
Bit 9 RSP Input Error
Bits 10 to 11: Not used.
Bits 12 to 15: Not used.
* Error Channel A Status bits will not turn ON even if a bit between bit 0 and bit 3 in the Channel Status is ON.
Bit 2 Channel Error
1
0
C4/84 000B
Error Channel A Status
Bit 0 CH1
1
0
Bit 1 CH2
Bit 2 CH3
Bit 3 CH4
Bits 4 to 7: Not used.
Bits 8 to 11: Not used.
Bits 12 to 15: Not used.
* CH2 to CH4 are the same as CH1.
Bit 3 Not used.
Bit 4 Expand Communications Error
1
0
C4/84 0004
Internal Communications Error Status
Bit 0 Expand Unit 1 Communications Error
Bit 1 Expand Unit 2 Communications Error
Bit 2 Expand Unit 3 Communications Error
Bit 3 Expand Unit 4 Communications Error
Bit 4 Expand Unit 5 Communications Error
Bit 5 Expand Unit 6 Communications Error
Bit 6 Expand Unit 7 Communications Error
Bit 7 Expand Unit 8 Communications Error
Bits 8 to 11: Not used.
Bits 12 to 15: Not used.
Bits 5 to 7: Not used.
C4/84 0102 (ch 1)
C4/84 0202 (ch 2)
C4/84 0302 (ch 3)
C4/84 0402 (ch 4)
Channel Alarm Status
Bit 0 Alarm 1
Bit 1 Alarm 2
Bit 2 Alarm 3
Bit 3 Not used.
Bit 4 Heater Overcurrent
Bit 5 HB Alarm
Bit 6 HS Alarm
Bit 7 OC Alarm
Bits 8 to 11: Not used.
Bit 12 Set Point Limiter Out of Range
Bit 13 Set Value Limiter Reverse Operation
Bit 14 MV Limiter Reverse Operation
Bit 15 Scaling Reverse Operation

Bits 8 to 9: Not used.			
Bit 10	I/O Error	1	I/O Error Status (C4/84 0005) Bit 0: Main Input 1 Count Error Bit 1: Main Input 2 Count Error Bit 2: Main Input 3 Count Error Bit 3: Main Input 4 Count Error Bits 4 to 7: Not used. Bits 8 to 11: Not used. Bits 12 to 15: Not used.
		0	
Bit 11	Lower-level I/O Error	1	Basic Unit/Expand Unit Error (C4/84 000F) Bit 0: Expand Unit 1 Error Bit 1: Expand Unit 2 Error Bit 2: Expand Unit 3 Error Bit 3: Expand Unit 4 Error Bit 4: Expand Unit 5 Error Bit 5: Expand Unit 6 Error Bit 6: Expand Unit 7 Error Bit 7: Expand Unit 8 Error Bits 8 to 11: Not used. Bits 12 to 15: Not used.
		0	
Bit 12	I/O Alarm	1	I/O Alarm A Status (C4/84 0006) Bit 0: CT1 Heater Overcurrent Bit 1: CT2 Heater Overcurrent Bits 2 to 3: Not used. Bits 4 to 7: Not used. Bits 8 to 11: Not used. Bits 12 to 15: Not used. I/O Alarm B Status (C4/84 0007) Bit 0: CT1 HB Alarm Bit 1: CT1 HS Alarm Bit 2: CT1 OC Alarm Bit 3: Not used. Bit 4: CT2 HB Alarm Bit 5: CT2 HS Alarm Bit 6: CT2 OC Alarm Bit 7: Not used. Bits 8 to 11: Not used. Bits 12 to 15: Not used.
		0	
Bit 13	Lower-level I/O Alarm	1	Basic Unit/Expand Unit Alarm Status (C4/84 0010) Bit 0: Expand Unit 1 Alarm Bit 1: Expand Unit 2 Alarm Bit 2: Expand Unit 3 Alarm Bit 3: Expand Unit 4 Alarm Bit 4: Expand Unit 5 Alarm Bit 5: Expand Unit 6 Alarm Bit 6: Expand Unit 7 Alarm Bit 7: Expand Unit 8 Alarm Bits 8 to 11: Not used. Bits 12 to 15: Not used.
		0	
Bit 14	I/O Notification	1	I/O Notification A Status (C4/84 0009) Bit 0: CT1 Heater Current Hold Bits 1 to 3: Not used. Bit 4: CT2 Heater Current Hold Bits 5 to 7: Not used. Bits 8 to 11: Not used. Bits 12 to 15: Not used.
		0	
Bit 15	Not used.		

Output Status	
Bit 0	Control Output 1
Bit 1	Control Output 2
Bit 2	Control Output 3
Bit 3	Control Output 4
Bits 4 to 7: Not used.	
Bits 8 to 11: Not used.	
Bits 12 to 15: Not used.	

C4/84 0012

Device B Status	
Bit 0	Save RAM 1
Bit 1	Save RAM 2
Bit 2	Save Control Parameters
Bit 3	Registration of unit configuration/ Registration of multiple reads
Bits 4 to 7: Not used.	
Bit 8	Write Mode
Bit 9	EEPROM
Bits 10 to 11: Not used.	
Bit 12	Configuration Registered
Bits 13 to 15: Not used.	

C4/84 0013

HFU

Device A Status		
Bit 0	Device Error	1
		0
Bit 1	Configuration Error	1
		0
Bit 2	Not used.	
Bit 3	External RAM Error at Operation	
Bit 4	Internal Communications Error	
Bit 5	Not used.	
Bit 6	Programless Link Error	
Bit 7	Not used.	
Bits 8 to 11: Not used.		
Bits 12 to 15: Not used.		

C4/84 0000

Device Error Status	
Bits 0 to 3: Not used.	
Bit 4	EEPROM Error
Bit 5	Not used.
Bit 6	Setting Value Error
Bit 7	Not used.
Bit 8	Not used.
Bit 9	Model Information Data Error
Bits 10 to 11: Not used.	
Bit 12	Model Information Mismatching Error
Bits 13 to 15: Not used.	

C4/84 0001

Configuration Error A Status	
Bits 0 to 3: Not used.	
Bits 4 to 7: Not used.	
Bit 8	Illegal Unit Arrangement
Bits 9 to 11: Not used.	
Bits 12 to 15: Not used.	

C4/84 0002

Device B Status	
Bit 0	
Bit 1	Save RAM 2
Bit 2	Not used.
Bit 3	Registration of unit configuration/ Registration of multiple reads
Bits 4 to 7: Not used.	
Bit 8	Write Mode
Bit 9	EEPROM
Bits 10 to 11: Not used.	
Bits 12 to 15: Not used.	

C4/84 0013

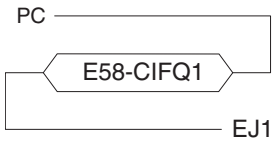
8-4 Determining the Error from the Current Situation for Communications Errors

This section provides troubleshooting information for communications errors.

CX-Thermo Support Software

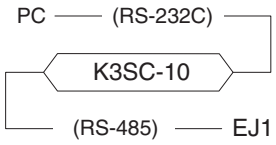
No Communications between the CX-Thermo Support Software and the EJ1

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="8">Cannot connect online

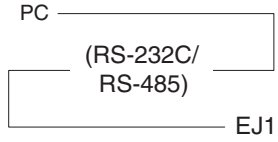
Connection
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>Computer</td><td>USB</td></tr><tr><td>EJ1 (EDU)</td><td>Port A (Connector)</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The USB-Serial Conversion Cable is not connected.</td><td>Connect the cable.</td></tr>
<tr><td>The CX-Thermo Support Software settings are incorrect.</td><td>Correct the communications settings.
Serial port: COM (See note.) (E58-CIFQ1 Serial Port)
Baud rate: 38.4 (kbps)
Data length: 7 (bit)
Stop bits: 2 (bit)
Parity: Even (bit)
Unit number: (See note.)
Note Match the serial port and unit number settings to the system used.</td></tr>
<tr><td>The serial port setting in the CX-Thermo Support Software communications settings does not show “E58-CIFQ1”.</td><td>The driver for the E58-CIFQ1 USB-Serial Conversion Cable is not installed.
Install the driver from the CD-ROM included with the product.</td></tr>
<tr><td>There is no device on the communications path with the specified unit number.</td><td>Specify a unit number in the communications settings for a device on the communications path.</td></tr>
<tr><td>There is a device on the communications path with the same unit number.</td><td>Change the unit number in the communications settings so that the unit numbers are not duplicated.</td></tr>
<tr><td>The Programmable Terminal is connected directly to port A and performing communications.</td><td>Both the Support Software and a Programmable Terminal cannot be connected to port A.
Either turn OFF the Programmable Terminal or move the Programmable Terminal to the System Screen and stop Programmable Terminal communications.</td></tr>
</table>

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="7">Cannot connect online

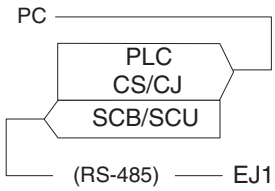
Connection
 

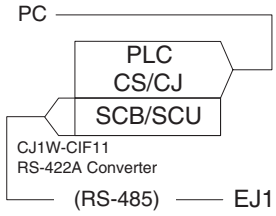
Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>Computer</td><td>Serial port</td></tr><tr><td>EJ1 (EDU)</td><td>Port A</td></tr></table>
K3SC-10: Interface Converter</td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>There is no power supply to the Interface Converter.</td><td>Supply power to the Interface Converter.</td></tr>
<tr><td>The CX-Thermo Support Software settings are incorrect.</td><td>Correct the communications settings.
Serial port: COM (See note.)
Baud rate: 38.4 (kbps)
Data length: 7 (bit)
Stop bits: 2 (bit)
Parity: Even (bit)
Unit number: (See note.)
Note Match the serial port and unit number settings to the system used.</td></tr>
<tr><td>The Interface Converter communications conditions are different from the EJ1 communications settings.</td><td>Refer to the Interface Converter manual and match the communications conditions to the EJ1 communications settings.</td></tr>
<tr><td>The Interface Converter connection is incorrect.</td><td>Refer to the computer, Interface Converter, and EJ1 manuals and wire the connection correctly.</td></tr>
<tr><td>There is no device on the communications path with the specified unit number.</td><td>Specify a unit number in the communications settings for a device on the communications path.</td></tr>
<tr><td>There is a device on the communications path with the same unit number.</td><td>Change the unit number in the communications settings so that the unit numbers are not duplicated.</td></tr>
<tr><td>Cannot connect online

Connection
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>Computer</td><td>---</td></tr><tr><td>EJ1 (HFU)</td><td>Port C</td></tr></table></td><td>The EJ1 is connected to port C on the HFU.</td><td>The CX-Thermo Support Software cannot be connected to the HFU. Connect it to port A on the EDU.</td></tr>
</table>

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="3">The EJ1 does not appear in the CX-Integrator's CompoWay/F network.

Connection
 

or
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>Computer</td><td>---</td></tr><tr><td>SCU</td><td>---</td></tr><tr><td>EJ1 (EDU)</td><td>Port A</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>CX-one is not compatible with the EJ1.</td><td>Use a version of CX-One that is compatible with the EJ1 (Ver.1.12 or later.)</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) and the EJ1 communications settings do not match.</td><td>Correct the communications settings for the Serial Communications Unit.
User/default settings: User settings
Serial communications mode: Serial Gateway
Data length: 7 (bit)
Stop bits: 2 (bit)
Parity: Even (bit)
Baud rate: 38.4 (kbps)

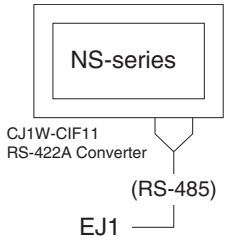
Refer to the *CX-Integrator Operation Manual* (W445).

Note The Serial Communications Board (SCB)/Unit (SCU) must be unit version 1.2 or later. Refer to *Unit Versions of CS/CJ-series Serial Communications Boards/Units* in the *Serial Communications Board/Unit Operation Manual* (W336) for information on checking unit versions.</td></tr>
</table>

Direct Connection of NS-series Programmable Terminals

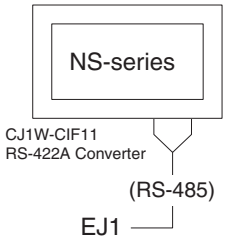
No Communications Between the EJ1 and a Directly Connected NS-Series PT

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="7">The Smart Active Part (SAP) does not communicate with the EJ1

Connection
 

Connection port
<table>
<tr><th></th><th>Connection port</th></tr>
<tr><td>PT</td><td>Port A/Port B</td></tr>
<tr><td>EJ1 (EDU)</td><td>Port A</td></tr>
</table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The Programmable Terminal connection is incorrect.</td><td>Refer to the Programmable Terminal, RS-422A Converter, and EJ1 manuals and wire the connection correctly.</td></tr>
<tr><td>The SAP is not compatible with the EJ1.</td><td>Use a SAP for the EJ1.</td></tr>
<tr><td>The SAP is not for direct connection.</td><td>Use a SAP for direct Programmable Terminal connection.</td></tr>
<tr><td>The RS-422A switch settings are incorrect.</td><td>Refer to the product manual and make the correct switch setting for the communications conditions.</td></tr>
<tr><td>An E58-CIFQ1 USB-Serial Conversion Cable is connected to port A and the CX-Thermo Support Software is started.</td><td>The CX-Thermo Support Software and Programmable Terminals cannot be used at the same time.
Close the CX-Thermo Support Software if using Programmable Terminals.
To temporarily use the CX-Thermo Support Software, either turn OFF the Programmable Terminal or move the Programmable Terminal to the System Screen and stop Programmable Terminal communications.</td></tr>
<tr><td>The Programmable Terminal communications conditions are different from the EJ1 communications settings.</td><td>Move the Programmable Terminal to the System Screen and set the communications destination for the communications port on the Communications Setting Screen to Temperature Controller and the baud rate to 38.4 (kbps).</td></tr>
</table>

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="9">The Smart Active Part (SAP) does not communicate with the EJ1.

Connection
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>PT</td><td>Port A/Port B</td></tr><tr><td>EJ1 (EDU)</td><td>Port B</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The Programmable Terminal connection is incorrect.</td><td>Refer to the Programmable Terminal, RS-422A Converter, and EJ1 manuals and wire the connection correctly.</td></tr>
<tr><td>The SAP is not compatible with the EJ1.</td><td>Use a SAP for the EJ1.</td></tr>
<tr><td>The SAP is not for direct connection.</td><td>Use a SAP for direct Programmable Terminal connection.</td></tr>
<tr><td>The RS-422A switch settings are incorrect.</td><td>Refer to the product manual and make the correct switch setting for the communications conditions.</td></tr>
<tr><td>The Programmable Terminal communications conditions are different from the EJ1 communications settings.</td><td>Set the PT's baud rate the same as the port B baud rate.</td></tr>
<tr><td colspan="2">Hint:
The EJ1 baud rate is set under the Port B Communications Baud Rate parameter.
• The available baud rate settings are 9.6 kbps (default), 19.2 kbps, 38.4 kbps, 57.6 kbps, and 115.2 kbps. (See note.)
• Set the settings other than baud rate to the following default settings.
Port B Communications Data Length: 7 (bit)
Port B Communications Parity: Even (bit)
Port B Communications Stop Bits: 2 (bit)

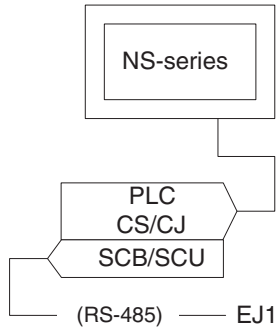
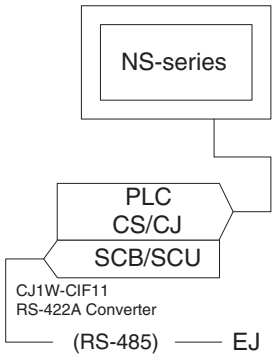
The PT communications settings are made on the PT System Screen.
• Move to the System Screen, display the Communications Settings Screen, and set the destination for the communications port to Temperature Controller.
• Set the baud rate the same as the EJ1 baud rate.</td></tr>
<tr><td>There is an HFU connected to the EJ1.</td><td>Port B cannot be used for communications if an HFU is connected to the EJ1.</td></tr>
<tr><td colspan="2">Hint:
When Using HFUs
Connect to port A on the Programmable Terminal.
The following restrictions apply:
• The HFU cannot be used at the same time as the CX-Thermo Support Software.
• The baud rate is fixed at 38.4 kbps.

If an HFU is Not Required
Disconnect the HFU and restart the EJ1.</td></tr>
</table>

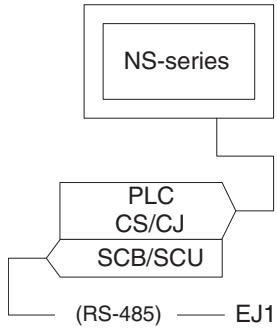
Note The baud rate and communications distance sometimes depend on the communications partner.

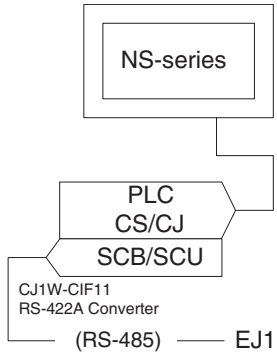
Serial Connection of NS-series Programmable Terminals

No Communications Between the EJ1 and the NS-Series PT Using Serial Connection

Status	Possible cause	Countermeasure
The Smart Active Part (SAP) does not communicate with the EJ1. Connection  or  Connection port **Connection port** PT: ---- PLC: --- SCU: --- EJ1 (EDU): Port A	There is no power supply to the EJ1.	Supply power from the EDU power supply terminal.
	The SAP is not compatible with the EJ1.	Use a SAP for the EJ1.
	The SAP is not for serial connection.	Use a SAP for serial Programmable Terminal connection.
	An E58-CIFQ1 USB-Serial Conversion Cable is connected to port A and the CX-Thermo Support Software is started.	The CX-Thermo Support Software and Programmable Terminals cannot be used at the same time. Close the CX-Thermo Support Software if using Programmable Terminals. To temporarily use the CX-Thermo Support Software, either turn OFF the Programmable Terminal or move the Programmable Terminal to the System Screen and stop Programmable Terminal communications.
	The Serial Communications Board (SCB)/Unit (SCU) and the EJ1 communications settings do not match.	Correct the communications settings for the Serial Communications Unit. User/default settings: User settings Serial communications mode: Serial Gateway Data length: 7 (bit) Stop bits: 2 (bit) Parity: Even (bit) Baud rate: 38.4 (kbps) Refer to the *CX-Integrator Operation Manual* (W445). **Note** The Serial Communications Board (SCB)/Unit (SCU) must be unit version 1.2 or later. Refer to *Unit Versions of CS/CJ-series Serial Communications Boards/Units* in the *Serial Communications Board/Unit Operation Manual* (W336) for information on checking unit versions.

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="6">The Smart Active Part (SAP) does not communicate with the EJ1.

Connection
 

or
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>PT</td><td>---</td></tr><tr><td>PLC</td><td>---</td></tr><tr><td>SCU</td><td>---</td></tr><tr><td>EJ1 (EDU)</td><td>Port B</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The SAP is not compatible with the EJ1.</td><td>Use an SAP for the EJ1.</td></tr>
<tr><td>The SAP is not for serial connection.</td><td>Use an SAP for serial Programmable Terminal connection.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) and the EJ1 communications settings do not match.</td><td>Set the Serial Communications Board's or Unit's baud rate the same as the port B baud rate.</td></tr>
<tr><td colspan="2">Hint:
The EJ1 baud rate is set under the Port B Communications Baud Rate parameter.
• The available baud rate settings are 9.6 kbps (default), 19.2 kbps, 38.4 kbps, 57.6 kbps, and 115.2 kbps. (See note.)
• Set the other parameters the same as the Serial Communications Unit as well, i.e., data length (7), parity (even), and stop bits (2).The values in parentheses are the default settings.

Refer to the PT and PLC manuals for PT and PLC communications settings. See Related Manuals on page xiv.

Set the communications conditions for the Serial Communications Unit as follows:
• User/default settings: User settings
• Serial communications mode: Serial Gateway
• Data length: 7 (bit)
• Stop bits: 2 (bit)
• Parity: Even (bit)
• Baud rate: Set the same baud rate as the EJ1.
Refer to the CX-Integrator Operation Manual (W445) for details.
Note The Serial Communications Board (SCB)/Unit (SCU) must be unit version 1.2 or later. Refer to Unit Versions of CS/CJ-series Serial Communications Boards/Units in the Serial Communications Board/Unit Operation Manual (W336) for information on checking unit versions.</td></tr>
<tr><td>There is an HFU connected to the EJ1.</td><td>Port B cannot be used for communications if an HFU is connected to the EJ1.</td></tr>
<tr><td colspan="2">Hint:
When Using HFUs
Connect to port A on the Serial Communications Unit.
The following restrictions apply:
• The HFU cannot be used at the same time as the CX-Thermo Support Software.
• The baud rate is fixed at 38.4 kbps.

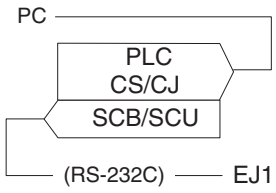
If an HFU Is Not Required
Disconnect the HFU and restart the EJ1.</td></tr>
</table>

Note The baud rate and communications distance sometimes depend on the communications partner.

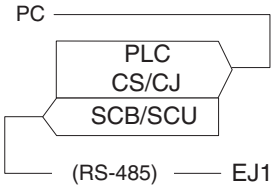
Programless Communications

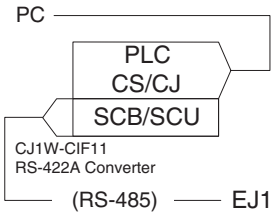
No Programless Communications between the PLC and the EJ1

<table>
<tr><th>Status</th><th>Possible cause</th><th>Countermeasure</th></tr>
<tr><td rowspan="6">No communications between the PLC and the EJ1.

Connection
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>SCU</td><td>---</td></tr><tr><td>EJ1 (HFU)</td><td>Port C (RS-232C)</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) wiring is incorrect.</td><td>Refer to the respective manuals and wire the connection correctly.
See Related Manuals on page xiv.</td></tr>
<tr><td>The port C communications are set to RS-485.</td><td>Turn ON pin 8 on the HFU settings switch 2 (SW2) to set to RS-232C.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) RS-485 port is connected to the EJ1 RS-232C port.</td><td>Connect the SCU RS-232C port to the EJ1 RS-232C port.</td></tr>
<tr><td>The EJ1 programless communications parameters are incorrect.</td><td>Refer to 5-1 Programless Communications in SECTION 5 Advanced Unit (HFU) Functions and check the settings.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) communications settings are incorrect.</td><td>Same as above.</td></tr>
<tr><td rowspan="6">No communications between the PLC and the EJ1.

Connection
 

or
 

Connection port
<table><tr><th></th><th>Connection port</th></tr><tr><td>SCU</td><td>---</td></tr><tr><td>EJ1 (HFU)</td><td>Port C (RS-485)</td></tr></table></td><td>There is no power supply to the EJ1.</td><td>Supply power from the EDU power supply terminal.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) wiring is incorrect.</td><td>Refer to the respective manuals and wire the connection correctly.
See Related Manuals on page xiv.</td></tr>
<tr><td>The port C communications are set to RS-232C.</td><td>Turn OFF pin 8 on the HFU settings switch 2 (SW2) to set to RS-485.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) RS-232C port is connected to the EJ1 RS-485 port.</td><td>Connect the SCU RS-485 port to the EJ1 RS-485 port.

Alternatively, connect the RS-422A Converter to the RS-232C port to convert to RS-485, then connect to the EJ1 RS-485 port.</td></tr>
<tr><td>The EJ1 programless communications parameters are incorrect.</td><td>Refer to 5-1 Programless Communications in SECTION 5 Advanced Unit (HFU) Functions and check the settings.</td></tr>
<tr><td>The Serial Communications Board (SCB)/Unit (SCU) communications settings are incorrect.</td><td>Same as above.</td></tr>
</table>

G3ZA (or G3PW V1.1)

Use the following table when the EJ1 cannot communicate with an G3ZA connected to it.

Status	Possible cause	Countermeasure
Communications are not possible between the G3ZA and EJ1 (the COM3 indicator does not flash).	Power is not supplied to the G3ZA.	Supply power to the G3ZA from the power supply terminals and reset the EJ1.
	The G3ZA is not connected to the EJ1.	Connect the G3ZA to the EJ1 using an EJ1C-CBLA050 Connecting Cable.
	Pin 7 on SW2 on the EJ1 is not ON.	Turn ON pin 7 on SW2 on the EJ1.
	Power was not supplied to the G3ZA when the EJ1 was started.	Supply power to the G3ZA and EJ1 at the same time or to the G3ZA first.
	Different baud rates are set in the G3ZA and EJ1.	Set SW2 on the G3ZA to 3 and reset the EJ1.
	The unit configuration was registered when the G3ZA was not connected to the EJ1 (default condition).	Send the Resister Unit Configuration: Reset operation command to the EJ1 Basic Unit to which the G3ZA is connected to clear the Unit configuration. The settings will be valid after the EJ1 is reset.
	The same unit number is set for more than one G3ZA.	Set the G3ZA unit numbers so that the same number is not used more than once for the same EJ1 Basic Unit.
	The registered G3ZA Unit configuration is different from the connected G3ZA Unit configuration.	Send the Resister Unit Configuration: Reset operation command to the EJ1 Basic Unit to which the G3ZA is connected to clear the Unit configuration, and then reset the EJ1. When the EJ1 starts again, send the Register Unit Configuration: Register operation command to register the connected G3ZA Units in the configuration. **Note** Bit 12 of variable type C4/84 0013 in Device B Status can be used to see if the connected G3ZA Unit configuration has been registered.
	The cable connecting the G3ZA and EJ1 is broken.	Replace the Connecting Cable between the G3ZA and EJ1.

Note If the EJ1 cannot communicate with a G3PW that is connected to it, the same error will occur as if the EJ1 were connected to a G3ZA. Confirm with the table above while replacing references of G3ZA with G3PW. However, if the baud rate is not the same, set the baud rate at the initial setting level for the G3PW to 3: 57.6 kbps, and reset the EJ1.

8-5 Determining the Error from the Current Situation for Temperature Measurement Errors

Error in Measured Temperature or Temperature Cannot Be Measured

	Possible cause	Countermeasure
Connection	The thermometer polarity or connected terminals are wrong.	• Rewire correctly.
	A thermometer that cannot be used with the EJ1 has been connected.	• Change to a compatible thermometer.
	The thermometer has burnt out, short-circuited, or deteriorated.	• Replace with a better quality thermometer.
	No thermometer is connected.	• Connect a thermometer.
	A compensating conductor applicable to the thermocouple has not been used.	• Directly connect a thermocouple with a long lead. • Use an applicable compensating conductor.
	A device using metal other than a thermocouple or compensating conductor has been connected between the thermocouple and EJ1 terminals.	• Connect a device specifically for thermocouples.
	The connection terminal screws are loose and the connection is imperfect.	• Tighten the screws securely.
	The thermocouple lead or compensating conductor is too long and is affected by the conductor resistance.	• Use a thicker compensating conductor. • Change the wiring location and shorten the wires.
	The resistance of the 3 conductors between the thermometer and the EJ1 terminals is different.	• Use conductors with the same resistance for all three terminals, A, B, and B terminals.
Installation	Affected by noise emitted by devices near the EJ1.	• Move the EJ1 away from devices emitting noise. • Connect a surge suppressor or noise filter to devices emitting noise.
	The thermometer lead is too close to the power line and is receiving induction noise from the power line.	• Separate the thermometer lead from the power line. • Run the thermometer lead through a different pipe or duct from the power line. • Do not wire the thermometer lead and the power line in parallel. • Wire a shorter thermometer lead. • Use a shield on the thermometer lead.
	The thermal response is slow because the installation position of the thermometer is too far from the control point.	• Install the thermometer with the end of the protective tube closer to the control point.
	The ambient temperature of the EJ1 exceeds the rating.	• Keep the ambient temperature between the rating range of −10 to 55°C.
	A wireless device is used in the vicinity of the EJ1.	• Shield the EJ1.
	The terminal block temperature is inconsistent due to heat radiated from peripheral devices.	• Move the EJ1 to a position where it will not be exposed to heat.
	An air current or draft is striking the EJ1 terminal block.	• Do not let air currents or drafts strike the terminal block.
Settings	The input type settings are incorrect.	• Correct the input type settings.
	The temperature unit settings are incorrect.	• Correct the temperature unit settings.
	The measured temperature seems incorrect due to the input compensation setting.	• Set the input compensation to 0.0.
Procedure	The input terminals for a thermocouple input are shorted.	• Connect a thermocouple.
	The thermometer was changed or the switch settings changed while power was ON.	• Cycle the power.

Easy Method for Checking Thermometers

Platinum resistance thermometers:
1. Connect a 100 Ω resistor between thermometer input terminals A and B and short B and B.
2. The EJ1 is working if the measured temperature is 0.0°C or 32.0°F.

Thermocouples:
1. Short the thermometer input terminals.
2. The EJ1 is working normally if the temperature in the vicinity of the terminal block is measured.

8-6 Determining the Error from the Current Situation for Temperature Control Errors

Temperature Is Not Rising

	Possible cause	Countermeasure
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	No load is connected to the control output terminal.	• Connect a load.
	The load polarity or connected terminals are wrong.	• Rewire correctly.
	The connection terminal screws are loose and the connection is imperfect.	• Tighten the screws securely.
	The heater power is not turned ON.	• Turn ON the heater power.
	Heater is burnt out or deteriorated.	• Replace with a better quality heater.
	The heater's heating capacity is insufficient.	• Replace with a heater with a bigger heating capacity. • If more than one heater is used, check for burnt out heaters and replace if necessary.
	An overheating protection device is operating.	• Set the set value for the overheating protection device to higher than the EJ1 set value.
Setting	The normal and reverse operation settings are incorrect.	• Make the correct settings.
	The PID constant is unsuitable.	• Execute AT (or ST with **V1.2**) to make the PID adjustments. • Set a suitable PID constant.
	RUN/STOP is set to STOP.	• Set to RUN.
	Operation After Power ON is set to STOP status.	• Set RUN/STOP to RUN. • To change to RUN the next time the power is turned ON, set Operation After Power ON to Continue and turn OFF the power while in RUN mode.
	The MV limiter is preventing the MV from increasing.	• Change the MV limiter to a suitable value.
	A cooling fan is operating.	• Stop the cooling fan.

The Measured Temperature Increases Above the Control Temperature

	Possible cause	Countermeasure
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	The load is connected to the incorrect channel so the heater is being controlled using control output from another channel.	• Rewire correctly.
	The contacts for the relay driven by control outputs are welded together.	• Replace with a higher quality relay.
	The SSR has short-circuited.	• Replace with a better quality SSR.
	Leakage current from the SSR is flowing to the heater.	• Connect breeder resistance to prevent the action of leakage current.
Settings	The normal and reverse operation settings are incorrect.	• Make the correct settings.
	The PID constant is unsuitable.	• Execute AT (or ST with **V1.2**) to make the PID adjustments. • Set a suitable PID constant.
	The MV limiter is preventing the MV from decreasing.	• Change the MV limiter to a suitable value.
	The EJ1 is outputting in manual mode.	• Stop manual mode.
Procedure	The control system is radiating heat.	• Execute heating and cooling control.
	The overshoot is too large.	• Use the countermeasures listed in the *Overshooting or Undershooting troubleshooting* table.

Overshooting or Undershooting

	Possible cause	Countermeasure
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	A general-purpose thermometer with slow thermal response has been connected to a control system with fast thermal response.	• Change to a sheathed thermometer.
Setting	The proportional band value is too low.	• Increase the proportional band within a range with an acceptable response delay. • Execute AT (or ST with **V1.2**) to make the PID adjustments.
	The integral time is too short.	• Increase the integral time within a range with an acceptable response delay. • Execute AT (or ST with **V1.2**) to make the PID adjustments.
	The derivative time is too short.	• Increase the derivative time within a range that does not adversely affect the stability of stabilization time. • Execute AT (or ST with **V1.2**) to make the PID adjustments.
	ON/OFF control is operating.	• Execute P control or PID control.
	The control cycle is too long for the control system with its fast thermal response.	• Shorten the control cycle.
	The overlap band in the heating and cooling control is set to a dead band by mistake.	• Set to an overlap band.

Hunting

The troubleshooting items for connection and setting problems are the same as for overshooting and undershooting, above.

	Possible cause	Countermeasure
Procedure	The heater's heating capacity is too large for the heating capacity of the control target.	• Use a heater with a heating capacity suitable for the control target.
	There is periodic disturbance, which changes the heating capacity of the control target.	• Change to an environment with as little periodic disturbance.
	Executing autotuning (AT).	• Hunting will not occur once autotuning has been completed.

8-7 Determining the Error from the Current Situation for Output Errors

No Control Outputs. No Alarm Outputs.

	Possible cause	Countermeasure
Connection	Measured temperature is wrong.	• Perform the action outlined in 7.5.
	The load polarity or connected terminals are wrong.	• Rewire correctly.
	A load exceeding the output rating is connected.	• Reduce the load to within the rating. • Get the Unit repaired if it is malfunctioning.
	No power supply for the load is connected to the transistor outputs.	• Use a power supply suitable for the output rating and load.
	The polarity of the load power supply for transistor outputs is incorrect.	• Rewire correctly.
Setting	Set the Operation After Power ON parameter to *Stop*.	• Execute a RUN (start operation) operation command after the power is turned ON. • Set the Operation After Power ON parameter to *Continue*.
	Control does not start.	• Execute a RUN (start operation) operation command.
	The specified channel is incorrect.	• Set the correct channel number.
	The control output assignments are incorrect.	• Set the correct control output assignments.
	The set point is incorrect.	• Set the correct set point.
	The specified bank is incorrect.	• Set the correct bank.
	A bank specification for all channels has been assigned to an event input, and an unintended bank has been selected.	• Assign the bank of the channel for which the bank is to be changed to an event input.
	Alarm mode is set to 0 (no alarm).	• Set the correct alarm mode.
	Alarm mode is set to an alarm with a standby sequence.	• Set to an alarm without a standby sequence.
	The deviation alarm and absolute-value alarm settings for alarm mode are incorrect.	• Set the correct alarm mode.

8-8 Determining the Error from the Current Situation for Heater Burnout Alarm Errors

HB (Heater Burnout) Alarm or Heater Burnout Not Detected

	Possible cause	Countermeasure
Connection	No current transformer (CT) is connected.	• Connect a CT.
	The CT is connected to the wrong channel.	• Connect the CT to the correct channel.
Setting	Control does not start.	• Start control.
	The ON time for control output is less than 100 ms.	• Set the control output ON time to 100 ms or more. →This will make the HB alarm operate.
	The HB alarm is not assigned to a control output or bus output.	• Assign an HB alarm to a control output or bus output.
	The heater power was turned ON after operation control started.	• Turn ON the heater power then start operation control.
	The heater burnout detection current is set to 0.0 or 100 A.	• Set an appropriate value between 0.1 and 99.9 A.
	The heater burnout detection current is the heater rated current.	• Measure the heater current and set the detection current value.
	The measured heater burnout detection current is not suitable.	• Set the detection current again, taking into consideration the voltage range of the heater power supply and current measurement error.
Procedure	The heater current value exceeds 100 A.	• Reduce the value to 100 A or less.
	The heater current is direct current (DC).	• The HB alarm will not operate under these conditions.
	A pure metal heater is used.	• Measure the heater current and set the detection current value.

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Specifications

Ratings

			TC4	TC2	HFU	EDU
Power supply voltage			24 VDC			
Operating voltage range			85% to 110% of rated voltage			
Power consumption (at maximum load)			5 W max.	4 W max.	2 W max.	---
Sensor inputs	**Thermocouple**		K, J, T, E, L, U, N, R, S, B, W, PLII		---	---
	Platinum resistance thermometer		Pt100, JPt100		---	---
	Infrared Thermosensor		10 to 70°C, 60 to 120°C, 115 to 165°C, 140 to 260°C		---	---
	Analog input	**Current input**	4 to 20 mA, 0 to 20 mA (input impedance: 150 Ω max.)		---	
		Voltage input	1 to 5 V, 0 to 5 V, 0 to 10 V (input impedance: 1 MΩ min.)		---	
Control outputs	**Voltage output**		Output voltage: 12 VDC Load current: 21 mA with short-circuit protection circuit		---	---
	Transistor output		---	Max. operating voltage: 30 VDC, Max. load current: 100 mA, Residual voltage: 1.5 V max., Leakage current: 0.4 mA max.	---	---
	Current output		---	4 to 20 mA DC (resolution: approx. 2,800) 0 to 20 mA DC (resolution: approx. 3,500) Load: 500 Ω max.	---	---
Auxiliary outputs (transistor outputs)			---	---	Max. operating voltage: 30 VDC, max. load current: 50 mA, residual voltage: 1.5 V max., leakage current: 0.4 mA max.	
Event inputs	**Leakage current**		---	Approx. 4 mA		---
	Contact input		---	ON: 1 kΩ max., OFF: 100 kΩ min.		---
	Non-contact input		---	ON: Residual voltage: 1.5 V max., OFF: Leakage current: 0.1 mA max.		---
Control method			2-PID or ON/OFF control		---	---
Setting method			Via communications			
Other functions			Depend on the model			
Ambient temperature range			Operating: −10°C to 55°C, Stored: −25°C to 65°C (with no icing or condensation)			
Ambient humidity range			Operating: 25% to 85%, Stored: 25% to 85%			
Altitude			2,000 m max.			
Inrush current (power supply)			Unit: 15 A or less			
Installation environment			Overvoltage Category II, Pollution Class 2 (IEC 61010-1 compliant)			

HB (Heater Burnout) Alarms, HS (Heater Short) Alarms, and OC (Heater Overcurrent) Alarm

Maximum heater current	Single Phase 100 A AC
Input current indication accuracy	(±5% FS) ±1 digit max.
Heater burnout (HB) alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater burnout (HB) alarm output turns OFF. 100.0 A: Heater burnout (HB) alarm output turns ON. Min. detection ON time: 100 ms (See note 1.)
Heater short (HS) alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater short (HS) alarm output turns ON. 100.0 A: Heater short alarm (HS) output turns OFF. Min. detection OFF time: 100 ms (See note 2.)
Heater overcurrent (OC) alarm setting range	0.1 to 99.9 A (in units of 0.1 A) 0.0 A: Heater overcurrent (OC) alarm output turns ON. 100.0 A: Heater overcurrent (OC) alarm output turns OFF. Min. detection ON time: 100 ms (See note 1.)

Note (1) Heater burnouts and heater overcurrents are not detected if the control output (heating) ON time is 100 ms or less.

Detection is also sometimes not possible if a contactor is used for the control output.

(2) A heater short is not detected if the control output (heating) OFF time is 100 ms or less. Detection is also sometimes not possible if a contactor is used for the control output.

Characteristics

		TC4/TC2	HFU	EDU
Indication accuracy	**Thermocouple input/ platinum resistance thermometer input**	(±0.5% of indication value (PV) or ±1°C, whichever is greater) ±1 digit max. (See note 3.)	---	---
	Analog input	(±0.5% FS) ±1 digit max.	---	---
	Heater burnout CT input	(±5% FS) ±1 digit max.	---	---
Hysteresis		0.1 to 999.9 EU (in units of 0.1 EU) (See note 4.)	---	---
Proportional band (P)		0.1 to 999.9 EU (in units of 0.1 EU) (See note 4.)	---	---
Integral time (I)		0 to 3,999 s (in units of 0.1 s)	---	---
Derivative time (D)		0.0 to 999.9 s (in units of 1 s)	---	---
Control period		0.5 s, 1 to 99 s (in units of 1 s)	---	---
Manual reset value		0.0% to 100.0% (in units of 0.1%)	---	---
Alarm output setting range		−1,999 to 9,999 (decimal point position depends on input type)	---	---
Sampling period		250 ms	---	---
Insulation resistance		20 MΩ min. (at 500 VDC)		
Dielectric strength		600 VAC, 50/60 Hz for 1 min between current-carrying terminals of different polarity		
Vibration resistance		10 to 55 Hz, 20 m/s^2 for 2 hours each in X, Y, and Z directions		
Shock resistance		150 m/s^2 max., 3 times each in 6 directions (on X, Y, and Z axes)		
Degree of protection		Rear case: IP20, Terminal section: IP00		Case: IP20
Memory protection		EEPROM (non-volatile memory) (number of writes: 100,000)		---
Weight		180 g	160 g	70 g

Note (3) W: (±0.5% of indication value (PV) or ±3°C, whichever is greater) ±1 digit max.
PLII: (±0.5% of indication value (PV) or ±2°C, whichever is greater) ±1 digit max.
K (30) **V1.2**: (±0.5% of indication value (PV) or ±1°C, whichever is greater) ±10 digit max. However, up to −100°C is ±2°C, ±10 digits max.
The indication accuracy of K, T and N thermocouples at a temperature of −100°C or less, and U and L thermocouples at any temperature is ±2°C ±1 digit maximum.
The indication accuracy of B thermocouples at a temperature of 400°C or less is unrestricted.
The indication accuracy of R and S thermocouples at a temperature of 200°C or less is ±3°C ±1 digit max.

(4) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

- Influence of Temperature or Voltage

R, S, B, and W thermocouple inputs: (±1% of PV or ±10°C, whichever is greater) ±1 digit max.

Thermocouple input (K(30)) **V1.2**: (±1% of PV or ±4°C, whichever is greater) ±10 digit max. However, up to −100°C is ±10°C.

Other thermocouple inputs: (±1% of PV or ±4°C, whichever is greater) ±1 digit max. But, K Sensors: −100°C max. or ±10°C max.

Platinum resistance thermometer inputs: (±1% of PV or ±2°C, whichever is greater) ±1 digit max.

Analog input: ±1% FS or ±1 digit, whichever is greater

Conditions:
Temperature range: −10°C to 23°C to 55°C, Voltage range: −15% to +10%

Current Transformer

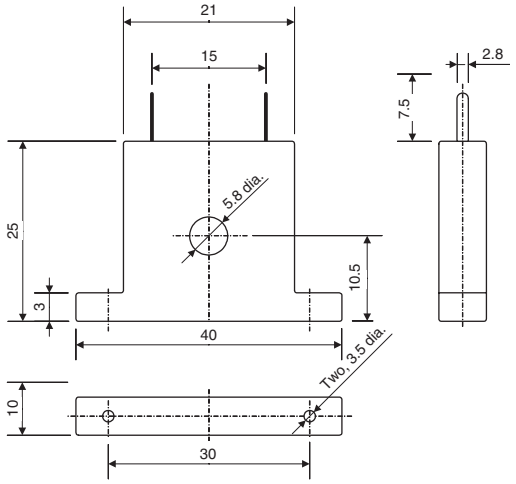
Specifications

Item	Specifications	
Model	E54-CT1	E54-CT3
Maximum continuous current	50 A	120 A (See note.)
Dielectric strength	1,000 VAC for 1 min	
Vibration resistance	50 Hz, 98 m/s^2	
Weight	Approx. 11.5 g	Approx. 50 g
Accessories	None	Armatures (2), plugs (2)

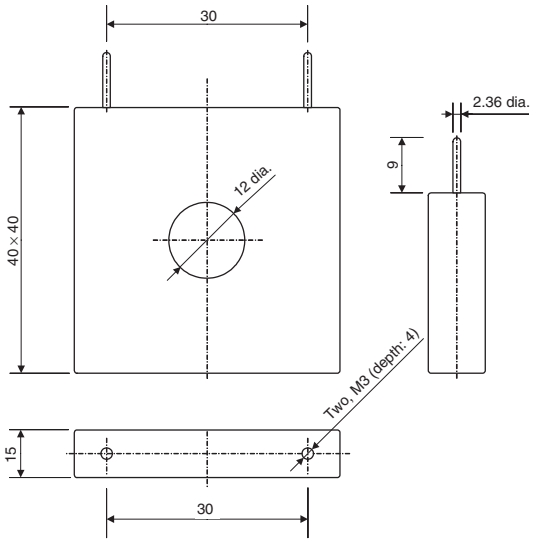
Note The maximum continuous current of the EJ1 is 100 A.

Dimensions

E54-CT1



E54-CT3



ASCII Table

Leftmost digit / Rightmost digit	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	‘ ‘	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	‘	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	DEL

Sensor Input Ranges

Input type		Specification	Set value	Setting range		Indication range	
				°C	°F	°C	°F
Temperature inputs	Platinum resistance thermometers	Pt100	0	–200 to 850	–300 to 1500	–220 to 870	–340 to 1540
			1	–199.9 to 500.0	–199.9 to 900.0	–219.9 to 520.0	–239.9 to 940.0
			2	0.0 to 100.0	0.0 to 210.0	–20.0 to 120.0	–40.0 to 250.0
		JPt100	3	–199.9 to 500.0	–199.9 to 900.0	–219.9 to 520.0	–239.9 to 940.0
			4	0.0 to 100.0	0.0 to 210.0	–20.0 to 120.0	–40.0 to 250.0
	Thermocouple	K	5	–200 to 1300	–300 to 2300	–220 to 1320	–340 to 2340
			6	–20.0 to 500.0	0.0 to 900.0	–40.0 to 520.0	–40.0 to 940.0
		J	7	–100 to 850	–100 to 1500	–120 to 870	–140 to 1540
			8	–20.0 to 400.0	0.0 to 750.0	–40.0 to 420.0	–40.0 to 790.0
		T	9	–200 to 400	–300 to 700	–220 to 420	–340 to 740
			10	–199.9 to 400.0	–199.9 to 700.0	–219.9 to 420.0	–239.9 to 740.0
		E	11	0 to 600	0 to 1100	–20 to 620	–40 to 1140
		L	12	–100 to 850	–100 to 1500	–120 to 870	–140 to 1540
		U	13	–200 to 400	–300 to 700	–220 to 420	–340 to 740
			14	–199.9 to 400.0	–199.9 to 700.0	–219.9 to 420.0	–239.9 to 740.0
		N	15	–200 to 1300	–300 to 2300	–220 to 1320	–340 to 2340
		R	16	0 to 1700	0 to 3000	–20 to 1720	–40 to 3040
		S	17	0 to 1700	0 to 3000	–20 to 1720	–40 to 3040
		B	18	100 to 1800	300 to 3200	0 to 1820	0 to 3240
		W	19	0 to 2300	0 to 4100	–20 to 2320	–40 to 4140
		PLII	20	0 to 1300	0 to 2300	–20 to 1320	–40 to 2340
	ES1B Infrared Thermosensor	10 to 70°C	21	0 to 90	0 to 190	–20 to 130	–40 to 270
		60 to 120°C	22	0 to 120	0 to 240	–20 to 160	–40 to 320
		115 to 165°C	23	0 to 165	0 to 320	–20 to 205	–40 to 400
		140 to 260°C	24	0 to 260	0 to 500	–20 to 300	–40 to 580
Analog inputs	Current input	4 to 20 mA	25	Any of the following ranges, by scaling: –1999 to 9999 –199.9 to 999.9 –19.99 to 99.99 –1.999 to 9.999		–5% to 105% of the setting range 0% to 105% for 0 to 20 mA	
		0 to 20 mA	26				
	Voltage input	1 to 5 V	27				
		0 to 5 V	28				
		0 to 10 V	29				
Temperature	Thermocouple	K	30 **V1.2**	–199.9 to 999.9	–199.9 to 999.9	–220.0 to 1320.0	–340.0 to 2340.0

- Applicable standards by input type are as follows:
  K,J,T,E,N,R,S,B: JIS C1602-1995
  L: Fe-CuNi, DIN43710-1985
  U: Cu-CuNi, DIN43710-1985
  W: W5Re/W26Re, ASTM E988-1990
  PLII: According to Platinel II Electromotive Force Table by Engelhard Corp.
  JPt100: JIS C1604-1989, JIS C1606-1989
  Pt100: JIS C1604-1997, IEC751

Parameter List

If variables without parentheses are used in communications, the set values will be eight-digit (double-word) data. If variables with parentheses are used in communications, the set values will be four-digit (word) data.

Example: Variable type C4: Double word (8 digits)

Variable type 84: Word (4 digits)

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C0 (80)	Monitor	0000	---	Process Value - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0001	---	Status - CH1	See *Status Lists* on page 256.	---	---	ch	●	---
		0002	---	Internal SP - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		Not used.								
		0004	---	MV Monitor (Heating) - CH1	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		0005	---	MV Monitor (Cooling) - CH1	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		Not used.								
		0100	---	Process Value - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0200	---	Process Value - CH3						
		⋮	⋮	⋮						
		0300	---	Process Value - CH4						
		⋮	⋮	⋮						
		8000	0080	Process Value - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		8001	0081	Process Value - CH2	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		8002	0082	Process Value - CH3	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		8003	0083	Process Value - CH4	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		8004	0084	Channel Alarm Status - CH1	See *Status Lists* on page 256.	---	---	ch	●	---
		8005	0085	Channel Alarm Status - CH2	See *Status Lists* on page 256.	---	---	ch	●	---
		8006	0086	Channel Alarm Status - CH3	See *Status Lists* on page 256.	---	---	ch	●	---
		8007	0087	Channel Alarm Status - CH4	See *Status Lists* on page 256.	---	---	ch	●	---
		8008	0088	Channel Status - CH1	See *Status Lists* on page 256.	---	---	ch	●	---
		8009	0089	Channel Status - CH2	See *Status Lists* on page 256.	---	---	ch	●	---
		800A	008A	Channel Status - CH3	See *Status Lists* on page 256.	---	---	ch	●	---
		800B	008B	Channel Status - CH4	See *Status Lists* on page 256.	---	---	ch	●	---
		800C	008C	Internal SP - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		800D	008D	Internal SP - CH2	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		800E	008E	Internal SP - CH3	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		800F	008F	Internal SP - CH4	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		8010	0090	MV Monitor (Heating) - CH1	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		8011	0091	MV Monitor (Heating) - CH2	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		8012	0092	MV Monitor (Heating) - CH3	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		8013	0093	MV Monitor (Heating) - CH4	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		8014	0094	Heater Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---
		8015	0095	Leakage Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---
		8016	0096	Heater Current Value 2 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---
		8017	0097	Leakage Current Value 2 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C1 (81) (See note.)	Can be changed during operation.	Not used.								
		0003	---	Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0004	---	Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0005	---	Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0006	---	Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0007	---	Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0008	---	Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		0009	---	Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	---	EU	ch	●	---
		Not used.								
		0103	---	Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0203	---	Set Point - CH3						
		⋮	⋮	⋮						
		0303	---	Set Point - CH4						
		⋮	⋮	⋮						
		8000	00C0	Present Bank Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	0	EU	BANK	●	---
		8001	00C1	Present Bank Set Point - CH2	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	0	EU	BANK	●	---
		8002	00C2	Present Bank Set Point - CH3	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	0	EU	BANK	●	---
		8003	00C3	Present Bank Set Point - CH4	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 2.)	0	EU	BANK	●	---

Note (1) The values in the current bank will be used for all set values.

(2) The decimal point position is determined by the sensor selection.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C4 (84)	Monitor	0000	0000	Device A Status	See *Status Lists* on page 256.	---	---	Common	●	●
		0001	0001	Device Error Status	See *Status Lists* on page 256.	---	---	Common	●	●
		0002	0002	Configuration Error A Status	See *Status Lists* on page 256.	---	---	Common	●	●
		0003	0003	Configuration Error B Status	See *Status Lists* on page 256.	---	---	Common	●	---
		0004	0004	Internal Communications Error Status	See *Status Lists* on page 256.	---	---	Common	●	---
		0005	0005	I/O Error Status	See *Status Lists* on page 256.	---	---	Common	●	---
		0006	0006	I/O Alarm A Status	See *Status Lists* on page 256.	---	---	Common	●	---
		0007	0007	I/O Alarm B Status	See *Status Lists* on page 256.	---	---	Common	●	---
		Not used.								
		0009	0009	I/O Notification A Status	See *Status Lists* on page 256.	---	---	Common	●	---
		Not used.								
		000B	000B	Error Channel A Status	See *Status Lists* on page 256.	---	---	Common	●	---
		Not used.								
		000F	000F	Basic Unit/Expand Unit Error	See *Status Lists* on page 256.	---	---	Common	●	---
		0010	0010	Basic Unit/Expand Unit Alarm	See *Status Lists* on page 256.	---	---	Common	●	---
		Not used.								
		0012	0012	Output Status	See *Status Lists* on page 256.	---	---	Common	●	---
		0013	0013	Device B Status	See *Status Lists* on page 256.	---	---	Common	●	●
		Not used.								
		0020	0020	Version	H' 00000000 to H' 0000FFFF	---	---	Common	●	●
		Not used.								
		0100	0200	Process Value - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note.)	---	EU	ch	●	---
		0101	0201	Channel Status - CH1	See *Status Lists* on page 256.	---	---	ch	●	---
		0102	0202	Channel Alarm Status - CH1	See *Status Lists* on page 256.	---	---	ch	●	---
		0103	0203	Internal SP - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note.)	---	EU	ch	●	---
		0104	0204	Local SP Monitor - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note.)	---	EU	ch	●	---
		0105	0205	Remote SP Monitor - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note.)	---	EU	ch	●	---
		0106	0206	Bank No. Monitor - CH1	H' 00000000 to H' 00000003 (0 to 3)	---	---	ch	●	---
		0107	0207	MV Monitor (Heating) - CH1	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		0108	0208	MV Monitor (Cooling) - CH1	H' FFFFFFCE to H' 0000041A (–5.0 to 105.0)	---	%	ch	●	---
		Not used.								
		010B	020B	Decimal Point Monitor - CH1	H' 00000000 to H' 00000003 (0 to 3)	---	---	ch	●	---
		Not used.								
		0200	0400	Process Value - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮	Note: The Remote SP Monitor - CH2 parameter is supported only by the TC4.					
		0300	0600	Process Value - CH3	Note: The Remote SP Monitor - CH3 parameter cannot be used.				TC4	---
		⋮	⋮	⋮						
		0400	0800	Process Value - CH4	Note: The Remote SP Monitor - CH4 parameter cannot be used.				TC4	---
		⋮	⋮	⋮						

Note The decimal point position is determined by the sensor selection.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C5 (85)	Monitor	0100	0220	Heater Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---
		0101	0221	Leakage Current Value 1 Monitor	H' 00000000 to H' 0000044C (0.0 to 110.0)	---	A	IO	TC2	---
		Not used.								
		0200	0420	Heater Current Value 2 Monitor	The rest are the same as Heater Current Value 1 Monitor.					
		⋮	⋮	⋮						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C9 (89)	Monitor	0100	E000	G3ZA1 - CH1 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0101	E001	G3ZA1 - CH2 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0102	E002	G3ZA1 - CH3 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0103	E003	G3ZA1 - CH4 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0104	E004	G3ZA1 - CH5 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0105	E005	G3ZA1 - CH6 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0106	E006	G3ZA1 - CH7 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0107	E007	G3ZA1 - CH8 Control Variable Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0108	E008	G3ZA1 - CH1 Status	---	---	---	NUM	●	---
		0109	E009	G3ZA1 - CH2 Status	---	---	---	NUM	●	---
		010A	E00A	G3ZA1 - CH3 Status	---	---	---	NUM	●	---
		010B	E00B	G3ZA1 - CH4 Status	---	---	---	NUM	●	---
		010C	E00C	G3ZA1 - CH5 Status	---	---	---	NUM	●	---
		010D	E00D	G3ZA1 - CH6 Status	---	---	---	NUM	●	---
		010E	E00E	G3ZA1 - CH7 Status	---	---	---	NUM	●	---
		010F	E00F	G3ZA1 - CH8 Status	---	---	---	NUM	●	---
		0110	E010	G3ZA1 - CH1 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT1 Heater ON Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0111	E011	G3ZA1 - CH2 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT2 Heater ON Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0112	E012	G3ZA1 - CH3 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT3 Heater ON Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0113	E013	G3ZA1 - CH4 Heater ON Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT4 Heater ON Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0114	E014	G3ZA1 - CH1 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT1 Heater OFF Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0115	E015	G3ZA1 - CH2 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT2 Heater OFF Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0116	E016	G3ZA1 - CH3 Heater OFF Current Monitor	H' 00000000 to H' 00000037(0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT3 Heater OFF Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		0117	E017	G3ZA1 - CH4 Heater OFF Current Monitor	H' 00000000 to H' 00000037 (0 to 55)	0	A	NUM	●	---
				G3ZA1 - CT4 Heater OFF Current Monitor **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A%	NUM	●	---
		Not used.								
		0200	E100	G3ZA2 - CH1 Control Variable Monitor	The rest are the same as the G3ZA1.					
		⋮	⋮	⋮						
		0300	E200	G3ZA3 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						
		0400	E300	G3ZA4 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						
		0500	E400	G3ZA5 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						
		0600	E500	G3ZA6 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						
		0700	E600	G3ZA7 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						
		0800	E700	G3ZA8 - CH1 Control Variable Monitor						
		⋮	⋮	⋮						

Note For details on G3ZA functions, refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No.Z200).

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
C9 (89)	Monitor	0100	E000	G3PW1 - Output Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		Not used.								
		0108	E008	G3PW1 - Status	---	---	---	NUM	●	---
		Not used.								
		0110	E00A	G3PW1 - Current Monitor	H' 00000000 to H' 000002EE (0.0 to 75.0)	0.0	A	NUM	●	---
		Not used.								
		0200	E100	G3PW2 - Output Monitor	The rest are the same as the G3PW1.					
		⋮	⋮	⋮						
		0300	E200	G3PW3 - Output Monitor						
		⋮	⋮	⋮						
		0400	E300	G3PW4 - Output Monitor						
		⋮	⋮	⋮						
		0500	E400	G3PW5 - Output Monitor						
		⋮	⋮	⋮						
		0600	E500	G3PW6 - Output Monitor						
		⋮	⋮	⋮						
		0700	E600	G3PW7 - Output Monitor						
		⋮	⋮	⋮						
		0800	E700	G3PW8 - Output Monitor						
		⋮	⋮	⋮						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
D0 (90)	Can be changed during operation.	0100	0240	Bank 0 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0101	0241	Bank 0 Proportional Band - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0102	0242	Bank 0 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0103	0243	Bank 0 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		0104	0244	Bank 0 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.) (See note 1.)	0	EU/s or EU/min	BANK	●	---
		0105	0245	Bank 0 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (Function stops when set to 0.) (See note 1.)	0	EU/s or EU/min	BANK	●	---
		Not used.								
		0107	0247	Bank 0 Manual Reset Value - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	50.0	%	BANK	●	---
		0108	0248	Bank 0 Cooling Coefficient - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	BANK	●	---
		0109	0249	Bank 0 Dead Band - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	BANK	●	---
		Not used.								
		010D	024D	Bank 0 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010E	024E	Bank 0 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010F	024F	Bank 0 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0110	0250	Bank 0 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0111	0251	Bank 0 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0112	0252	Bank 0 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0113	0253	Bank 0 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0114	0254	Bank 0 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0115	0255	Bank 0 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0116	0256	Bank 0 Proportional Band (Cooling) - CH1 **V1.2**	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0117	0257	Bank 0 Integral Time (Cooling) - CH1 **V1.2**	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0118	0258	Bank 0 Derivative Time (Cooling) - CH1 **V1.2**	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		Not used.								
		0200	0440	Bank 0 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	0640	Bank 0 Set Point - CH3					TC4	---
		⋮	⋮	⋮						
		0400	0840	Bank 0 Set Point - CH4					TC4	---
		⋮	⋮	⋮						

Note (1) The decimal point position is determined by the sensor selection.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

(3) **V1.1** ... Can only be used by improved models. For details on improved models, refer to *Functional Upgrades* on page xxvi.

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D1 (91)	Can be changed during operation.	0100	0260	Bank 1 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0101	0261	Bank 1 Proportional Band - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0102	0262	Bank 1 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0103	0263	Bank 1 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		0104	0264	Bank 1 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		0105	0265	Bank 1 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		Not used.								
		0107	0267	Bank 1 Manual Reset Value - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	50.0	%	BANK	●	---
		0108	0268	Bank 1 Cooling Coefficient - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	BANK	●	---
		0109	0269	Bank 1 Dead Band - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	BANK	●	---
		Not used.								
		010D	026D	Bank 1 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010E	026E	Bank 1 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010F	026F	Bank 1 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0110	0270	Bank 1 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0111	0271	Bank 1 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0112	0272	Bank 1 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0113	0273	Bank 1 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0114	0274	Bank 1 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0115	0275	Bank 1 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0116	0276	Bank 1 Proportional Band (Cooling) - CH1 **V1.2**	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0117	0277	Bank 1 Integral TIme (Cooling) - CH1 **V1.2**	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0118	0278	Bank 1 Derivative Time (Cooling) - CH1 **V1.2**	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		Not used.								
		0200	0460	Bank 1 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	0660	Bank 1 Set Point - CH3					TC4	---
		⋮	⋮	⋮						
		0400	0860	Bank 1 Set Point - CH4					TC4	---
		⋮	⋮	⋮						

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D2 (92)	Can be changed during operation.	0100	0280	Bank 2 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0101	0281	Bank 2 Proportional Band - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0102	0282	Bank 2 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0103	0283	Bank 2 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		0104	0284	Bank 2 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		0105	0285	Bank 2 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		Not used.								
		0107	0287	Bank 2 Manual Reset Value - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	50.0	%	BANK	●	---
		0108	0288	Bank 2 Cooling Coefficient - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	BANK	●	---
		0109	0289	Bank 2 Dead Band - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	BANK	●	---
		Not used.								
		010D	028D	Bank 2 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010E	028E	Bank 2 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010F	028F	Bank 2 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0110	0290	Bank 2 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0111	0291	Bank 2 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0112	0292	Bank 2 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0113	0293	Bank 2 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0114	0294	Bank 2 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0115	0295	Bank 2 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0116	0296	Bank 2 Proportional Band (Cooling) - CH1 V1.2	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0117	0257	Bank 2 Integral TIme (Cooling) - CH1 V1.2	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0118	0258	Bank 2 Derivative Time (Cooling) - CH1 V1.2	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		Not used.								
		0200	0480	Bank 2 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	0680	Bank 2 Set Point - CH3					TC4	---
		⋮	⋮	⋮						
		0400	0880	Bank 2 Set Point - CH4					TC4	---
		⋮	⋮	⋮						

Note (1) The decimal point position is determined by the sensor selection.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D3 (93)	Can be changed during operation.	0100	02A0	Bank 3 Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0101	02A1	Bank 3 Proportional Band - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0102	02A2	Bank 3 Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0103	02A3	Bank 3 Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		0104	02A4	Bank 3 SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		0105	02A5	Bank 3 SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		Not used.								
		0107	02A7	Bank 3 Manual Reset Value - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	50.0	%	BANK	●	---
		0108	02A8	Bank 3 Cooling Coefficient - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	BANK	●	---
		0109	02A9	Bank 3 Dead Band - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	BANK	●	---
		Not used.								
		010D	02AD	Bank 3 Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010E	02AE	Bank 3 Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010F	02AF	Bank 3 Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0110	02B0	Bank 3 Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0111	02B1	Bank 3 Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0112	02B2	Bank 3 Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0113	02B3	Bank 3 Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0114	02B4	Bank 3 Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0115	02B5	Bank 3 Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0116	02B6	Bank 3 Proportional Band (Cooling) - CH1 V1.2	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0117	02B7	Bank 3 Integral TIme (Cooling) - CH1 V1.2	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0118	02B8	Bank 3 Derivative Time (Cooling) - CH1 V1.2	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		Not used.								
		0200	04A0	Bank 3 Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	06A0	Bank 3 Set Point - CH3					TC4	---
		⋮	⋮	⋮						
		0400	08A0	Bank 3 Set Point - CH4					TC4	---
		⋮	⋮	⋮						

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D4 (94)	Can be changed during operation.	0100	02C0	Present Bank Set Point - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0101	02C1	Present Bank Proportional Band - CH1	H' 00000001 to H' 0000270F (1 to 9999) (See note 2.)	8.0	EU	BANK	●	---
		0102	02C2	Present Bank Integral Time - CH1	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0103	02C3	Present Bank Derivative Time - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		0104	02C4	Present Bank SP Ramp Rise Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
								BANK		---
		0105	02C5	Present Bank SP Ramp Fall Value - CH1	H' 00000000 to H' 0000270F (0 to 9999) (See note 1.) (Function stops when set to 0.)	0	EU/s or EU/min	BANK	●	---
		Not used.								
		0107	02C7	Present Bank Manual Reset Value - CH1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	50.0	%	BANK	●	---
		0108	02C8	Present Bank Cooling Coefficient - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	BANK	●	---
		0109	02C9	Present Bank Dead Band - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	BANK	●	---
		Not used.								
		010D	02CD	Present Bank Alarm Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010E	02CE	Present Bank Alarm Upper Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		010F	02CF	Present Bank Alarm Lower Limit Value 1 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0110	02D0	Present Bank Alarm Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0111	02D1	Present Bank Alarm Upper Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0112	02D2	Present Bank Alarm Lower Limit Value 2 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0113	02D3	Present Bank Alarm Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0114	02D4	Present Bank Alarm Upper Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0115	02D5	Present Bank Alarm Lower Limit Value 3 - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	BANK	●	---
		0116	02D6	Present Bank Proportional Band (Cooling) - CH1 **V1.2**	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	8.0	EU	BANK	●	---
		0117	02D7	Present Bank Integral TIme (Cooling) - CH1 **V1.2**	H' 00000000 to H' 00000F9F (0 to 3999)	233	s	BANK	●	---
		0118	02D8	Present Bank Derivative Time (Cooling) - CH1 **V1.2**	H' 00000000 to H' 0000270F (0.0 to 999.9)	40.0	s	BANK	●	---
		Not used.								
		0200	04C0	Present Bank Set Point - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	06C0	Present Bank Set Point - CH3					TC4	---
		⋮	⋮	⋮						
		0400	08C0	Present Bank Set Point - CH4					TC4	---
		⋮	⋮	⋮						

Note (1) The decimal point position is determined by the sensor selection.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D5 (95)	Can be changed during operation.	0100	02E0	Input Digital Filter - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9)	0.0	s	ch	●	---
		0101	02E1	Input Value 1 for Input Correction - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	0	EU	ch	●	---
		0102	02E2	Input Shift 1 - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	ch	●	---
		0103	02E3	Input Value 2 for Input Correction - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	1000	EU	ch	●	---
		0104	02E4	Input Shift 2 - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	ch	●	---
		0105	02E5	MV at PV Error - CH1 Standard Control: Heating and Cooling Control:	 H' FFFFFFCE to H' 0000041A (–5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (–105.0 to 105.0)	0	%	ch	●	---
		0106	02E6	MV at Stop - CH1 Standard Control: Heating and Cooling Control:	 H' FFFFFFCE to H' 0000041A (–5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (–105.0 to 105.0)	0	%	ch	●	---
		Not used.								
		0109	02E9	MV Upper Limit - CH1 Standard Control: Heating and Cooling Control:	 H' FFFFFFCE to H' 0000041A (–5.0 to 105.0) H' 00000000 to H' 0000041A (–0.0 to 105.0)	105.0	%	ch	●	---
		010A	02EA	MV Lower Limit - CH1 Standard Control: Heating and Cooling Control:	 H' FFFFFFCE to H' 0000041A (–5.0 to 105.0) H' FFFFFBE6 to H' 00000000 (–105.0 to 0.0)	–105.0	%	ch	●	---
		010B	02EB	Hysteresis (Heating) - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	1.0	EU	ch	●	---
		010C	02EC	Hysteresis (Cooling) - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note 2.)	1.0	EU	ch	●	---
		010D	02ED	Alpha - CH1	H' 00000000 to H' 00000064 (0.00 to 1.00)	0.65	---	ch	●	---
		010E	02EE	Manual MV - CH1 Standard Control: Heating and Cooling Control:	 H' FFFFFFCE to H' 0000041A (–5.0 to 105.0) H' FFFFFBE6 to H' 0000041A (–105.0 to 105.0)	0	%	ch	●	---
		010F	02EF	SP Upper Limit - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	9999	EU	ch	●	---
		0110	02F0	SP Lower Limit - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999) (See note 1.)	–1999	EU	ch	●	---
		0111	02F1	Disturbance Gain - CH1	H' FFFFFF9C to H' 00000064 (–1.00 to 1.00)	0.65	---	ch	●	---
		0112	02F2	Disturbance Time Constant - CH1	H' 00000001 to H' 0000270F (0.01 to 99.99)	1.00	---	ch	●	---
		0113	02F3	Disturbance Rectification Band - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9) (See note 2.)	0.0	EU	ch	●	---
		0114	02F4	Disturbance Judgment Width - CH1	H' FFFFF831 to H' 0000270F (–199.9 to 999.9) (See note 2.)	0.0	EU	ch	●	---
		Not used.								
		0200	04E0	Input Digital Filter - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	06E0	Input Digital Filter - CH3					TC4	---
		⋮	⋮	⋮						
		0400	08E0	Input Digital Filter - CH4					TC4	---
		⋮	⋮	⋮						

Note (1) The decimal point position is determined by the sensor selection.

(2) The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
D6 (96)	Can be changed during operation.	0100	0300	Heater Burnout 1 Detection	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	A	IO	TC2	---
		0101	0301	HS Alarm 1	H' 00000000 to H' 000003E8 (0.0 to 100.0)	100.0	A	IO	TC2	---
		0102	0302	Heater Overcurrent 1 Detection	H' 00000000 to H' 000003E8 (0.0 to 100.0)	100.0	A	IO	TC2	---
		Not used.								
		0200	0500	Heater Burnout 2 Detection	The rest are the same as from Heater Burnout Detection 1 to Heater Overcurrent Detection 1.					
		⋮	⋮	⋮						

Note (1) Parameters with the following mark are supported only by version 1.1 Temperature Controllers: **V1.1**

Refer to *Functional Upgrades* on page xxvi for details on upgraded functionality.

(2) **V1.2** ... Can only be used by improved models.

For details on improved models, refer to *Functional Upgrades* on page xxiv.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
DA (9A)	Can be changed during operation.	0100	F000	G3ZA1 - CH1 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0101	F001	G3ZA1 - CH2 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0102	F002	G3ZA1 - CH3 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0103	F003	G3ZA1 - CH4 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0104	F004	G3ZA1 - CH5 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0105	F005	G3ZA1 - CH6 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0106	F006	G3ZA1 - CH7 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0107	F007	G3ZA1 - CH8 Slope	H' 00000000 to H' 00000FA0 (0.0 to 400.0)	100.0	%	NUM	●	---
		0108	F008	G3ZA1 - CH1 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		0109	F009	G3ZA1 - CH2 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010A	F00A	G3ZA1 - CH3 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010B	F00B	G3ZA1 - CH4 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010C	F00C	G3ZA1 - CH5 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010D	F00D	G3ZA1 - CH6 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010E	F00E	G3ZA1 - CH7 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		010F	F00F	G3ZA1 - CH8 Offset	H' FFFFF060 to H' 00000FA0 (–400.0 to 400.0)	0.0	%	NUM	●	---
		0110	F010	G3ZA1 - CH1 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	1	---	NUM	●	---
		0111	F011	G3ZA1 - CH2 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	2	---	NUM	●	---
		0112	F012	G3ZA1 - CH3 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	3	---	NUM	●	---
		0113	F013	G3ZA1 - CH4 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	4	---	NUM	●	---
		0114	F014	G3ZA1 - CH5 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	5	---	NUM	●	---
		0115	F015	G3ZA1 - CH6 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	6	---	NUM	●	---
		0116	F016	G3ZA1 - CH7 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	7	---	NUM	●	---
		0117	F017	G3ZA1 - CH8 Source Channel	H' 00000001 to H' 00000008 (1 to 8)	8	---	NUM	●	---
		0118	F018	G3ZA1 - CH1 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
				G3ZA1 - CT1 Heater Burnout Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0119	F019	G3ZA1 - CH2 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
				G3ZA1 - CT2 Heater Burnout Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		011A	F01A	G3ZA1 - CH3 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
				G3ZA1 - CT3 Heater Burnout Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		011B	F01B	G3ZA1 - CH4 Heater Burnout Detection Value	H' 00000000 to H' 00000032 (0 to 50)	0	A	NUM	●	---
				G3ZA1 - CT4 Heater Burnout Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		011C	F01C	G3ZA1 - CH1 SSR Short Circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT1 SSR Short Circuit Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		011D	F01D	G3ZA1 - CH2 SSR Short Circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT2 SSR Short Circuit Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		011E	F01E	G3ZA1 - CH3 SSR Short Circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT3 SSR Short Circuit Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		011F	F01F	G3ZA1 - CH4 SSR Short Circuit Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT4 SSR Short Circuit Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		0120	F020	G3ZA1 - CH1 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT1 Heater Overcurrent Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		0121	F021	G3ZA1 - CH2 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT2 Heater Overcurrent Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		0122	F022	G3ZA1 - CH3 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT3 Heater Overcurrent Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		0123	F023	G3ZA1 - CH4 Heater Overcurrent Detection Value	H' 00000000 to H' 00000032 (0 to 50)	50	A	NUM	●	---
				G3ZA1 - CT4 Heater Overcurrent Detection Value **V2**	H' 00000000 to H' 000000A5 (0 to 165)	165	A/%	NUM	●	---
		0124	F024	G3ZA1 - Offset Control	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	1	---	NUM	●	---

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
DA (9A)	Can be changed during operation. (See note 2.)	0140	F040	G3ZA1 - CH1 Control Variable Monitor V2	H' 00000000 H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0141	F041	G3ZA1 - CH2 Control Variable Monitor V2	H' 00000000 H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0142	F042	G3ZA1 - CH3 Control Variable Monitor V2	H' 00000000 H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0143	F043	G3ZA1 - CH4 Control Variable Monitor V2	H' 00000000 H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0144	F044	G3ZA1 - CH1 Status V2	---	---	---	NUM	●	---
		0145	F045	G3ZA1 - CH2 Status V2	---	---	---	NUM	●	---
		0146	F046	G3ZA1 - CH3 Status V2	---	---	---	NUM	●	---
		0147	F047	G3ZA1 - CH3 Status V2	---	---	---	NUM	●	---
		0148	F048	G3ZA1 - CT1 Effective Current Monitor V2	H' 00000000 H' 00000672 (0.0 to 165.0)	0.0	A/%	NUM	●	---
		0149	F049	G3ZA1 - CT2 Effective Current Monitor V2	H' 00000000 H' 00000672 (0.0 to 165.0)	0.0	A/%	NUM	●	---
		014A	F04A	G3ZA1 - CT3 Effective Current Monitor V2	H' 00000000 H' 00000672 (0.0 to 165.0)	0.0	A/%	NUM	●	---
		014B	F04B	G3ZA1 - CT4 Effective Current Monitor V2	H' 00000000 H' 00000672 (0.0 to 165.0)	0.0	A/%	NUM	●	---
		014C	F04C	G3ZA1 - CT1 Heater ON Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		014D	F04D	G3ZA1 - CT2 Heater ON Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		014E	F04E	G3ZA1 - CT3 Heater ON Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		014F	F04F	G3ZA1 - CT4 Heater ON Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0150	F050	G3ZA1 - CT1 Heater OFF Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0151	F051	G3ZA1 - CT2 Heater OFF Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0152	F052	G3ZA1 - CT3 Heater OFF Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0153	F053	G3ZA1 - CT4 Heater OFF Current Monitor V2	H' 00000000 to H' 000000A5 (0 to 165)	0	A/%	NUM	●	---
		0154	F054	Version V2	---	---	---	NUM	●	---
		0180	F080	G3ZA1 - Send Standby Time (See note 1.)	H' 00000000 to H' 00000063 (0 to 99)	1	ms	NUM	●	---
		0181	F081	G3ZA1 - Communications Timeout Time (See note 1.)	H' 00000000 to H' 0000003C (0 to 60) (Function stops when set to 0.)	0	min	NUM	●	---
		0182	F082	G3ZA1 - Setting Operation for Errors	H' 00000000: Continue with error clear (0) H' 00000001: Continue without error clear (1) H' 00000002: Stop (2)	0	---	NUM	●	---
		0183	F083	G3ZA1 - Offset Value	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		0184	F084	G3ZA1 - Hysteresis	H' 00000001 to H' 0000000A (1 to 10)	1	A	NUM	●	---
		0185	F085	G3ZA1 - SSR Drive Selection V2	H' 00000000: Zero-cross SSR for single-phase heater, optimum cycle control (0) H' 00000001: Non-zero-cross SSR for single-phase heater, soft-start optimum cycle control (1) H' 00000002: Zero-cross SSR for three-phase heater, three-phase optimum cycle control (2)	0	---	NUM	●	---
		0186	F086	G3ZA1 - Current Monitor Display Selection V2	H' 00000000: 0 to 50 A (0) H' 00000001: 0 to 150 A (1) H' 00000002: 0% to 100% (2)	0	---	NUM	●	---
		0187	F087	G3ZA1 - Communications Hysteresis V2	H' 00000000 to H' 0000012C (0.0 to 30.0)	1.0	%	NUM	●	---
		0188	F088	G3ZA1 - Communications Timeout Time 2 (See note 1.) V2	H' 00000000: Disabled H' 00000001 to H' 00000E10 (1 to 3600)	0	s	NUM	●	---
		0189	F089	G3ZA1 - CT1 Assignment (See note 1.) V2	H' 00000000: Disabled (0) H' 00000001: ch1 (1) H' 00000002: ch2 (2) H' 00000003: ch3 (3) H' 00000004: ch4 (4)	1	---	NUM	●	---
		018A		G3ZA1 - CT2 Assignment (See note 1.) V2		2	---	NUM	●	---
		018B		G3ZA1 - CT3 Assignment (See note 1.) V2		3	---	NUM	●	---
		018C		G3ZA1 - CT4 Assignment (See note 1.) V2		4	---	NUM	●	---
		01C0	F08A	G3ZA1 - CH1 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C1	F08B	G3ZA1 - CH2 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C2	F08C	G3ZA1 - CH3 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C3	F0C0	G3ZA1 - CH4 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C4	F0C1	G3ZA1 - CH5 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C5	F0C2	G3ZA1 - CH6 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C6	F0C3	G3ZA1 - CH7 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C7	F0C4	G3ZA1 - CH8 Soft Increase Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	20.0	s	NUM	●	---
		01C8	F0C5	G3ZA1 - CH1 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01C9	F0C6	G3ZA1 - CH2 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01CA	F0C7	G3ZA1 - CH3 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01CB	F0C8	G3ZA1 - CH4 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
DA (9A)	Can be changed during operation.	01CC	F0CC	G3ZA1 - CH5 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01CD	F0CD	G3ZA1 - CH6 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01CE	F0CE	G3ZA1 - CH7 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01CF	F0CF	G3ZA1 - CH8 Soft Decrease Time V2	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		01D0	F0D0	G3ZA1 - CH1 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D1	F0D1	G3ZA1 - CH2 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D2	F0D2	G3ZA1 - CH3 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D3	F0D3	G3ZA1 - CH4 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D4	F0D4	G3ZA1 - CH5 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D5	F0D5	G3ZA1 - CH6 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D6	F0D6	G3ZA1 - CH7 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D7	F0D7	G3ZA1 - CH8 Control Switch MV Threshold V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	20.0	%	NUM	●	---
		01D8	F0D8	G3ZA1 - CH1 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01D9	F0D9	G3ZA1 - CH2 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DA	F0DA	G3ZA1 - CH3 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DB	F0DB	G3ZA1 - CH4 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DC	F0DC	G3ZA1 - CH5 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DD	F0DD	G3ZA1 - CH6 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DE	F0DE	G3ZA1 - CH7 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01DF	F0DF	G3ZA1 - CH8 MV at Communications Error V2	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		01E0	F0E0	G3ZA1 - Number of Current Error Detection Delays V2	H' 00000000 to H' 000000C8 (0 to 200)	3	Times	NUM	●	---
		Not used.								
		0200	F100	G3ZA2 - CH1 Slope	The rest are the same as the G3ZA1.					
		⋮	⋮	⋮						
		0300	F200	G3ZA3 - CH1 Slope						
		⋮	⋮	⋮						
		0400	F300	G3ZA4 - CH1 Slope						
		⋮	⋮	⋮						
		0500	F400	G3ZA5 - CH1 Slope						
		⋮	⋮	⋮						
		0600	F500	G3ZA6 - CH1 Slope						
		⋮	⋮	⋮						
		0700	F600	G3ZA7 - CH1 Slope						
		⋮	⋮	⋮						
		0800	F700	G3ZA8 - CH1 Slope						
		⋮	⋮	⋮						

Note (1) Valid after a Software Reset operation command or after power is turned ON. Refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No. Z200).

(2) Parameters with the following mark are supported only by version 2 G3ZA Power Controllers: **V2**
Refer to the *G3ZA Multi-channel Power Controller User's Manual* (Cat. No. Z200) for information on G3ZA functionality.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
DA (9A) V1.1	Can be changed during operation.	0100	F000	G3PW1-Internal Duty Setting	H' 00000000 to H' 000003E8 (0.0 to 100.0)	100	%	NUM	●	---
		0101	F001	G3PW1-Base-up Value	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0102	F002	G3PW1-Soft-start Up Time	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.5	s	NUM	●	---
		0103	F003	G3PW1-Soft-start Down Time	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	s	NUM	●	---
		0104	F004	G3PW1-Output Upper Limit	H' 00000001 to H' 000003E8 (0.1 to 100.0)	100.0	%	NUM	●	---
		0105	F005	G3PW1-Output Lower Limit	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	%	NUM	●	---
		0106	F006	G3PW1-Heater Burnout Threshold	H' 00000000 to H' 00000064 (1 100)	100	%	NUM	●	---
		0107	F007	G3PW1-Heater Characteristic Resistance for Phase Control	H' 00000000 to H' 00000064 (1 to 100)	100	%	NUM	●	---
		0108	F008	G3PW1-Heater Characteristic Resistance for Optimum Cycle Control	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	W	NUM	●	---
		0109	F009	G3PW1-Heater Burnout Detection Lower Limit	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0140	F040	G3PW1-Input Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0141	F041	G3PW1-Duty Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0142	F042	G3PW1-Output Monitor	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0143	F043	G3PW1-Phase Angle Monitor	H' 00000000 H' 000003E8 (0.0 to 100.0)	0.0	%	NUM	●	---
		0144	F044	G3PW1-Current Monitor	H' 00000000 to H' 000002EE (0.0 to 75.0)	0.0	A	NUM	●	---
		0145	F045	G3PW1-Total Run Time Monitor	H' 00000000 to H' 000003E7 (0.0 to 99.9)	0.0	kh	NUM	●	---
		0146	F046	G3PW1-Status	---	---	---	NUM	●	---
		0154	F054	Version	---	---	---	NUM	●	---
		0180	F080	G3PW1-Send Wait Time	H' 00000000 to H' 00000063 (0 to 99)	1	ms	NUM	●	---
		0181	F081	G3PW1-Communications Timeout Time	H' 00000000 to H' 000003E7 (0 to 999)	0	s	NUM	●	---
		0184	F084	G3PW1-Communications Main Setting Number	H'00000000: Automatic Assignment (0) H'00000001: EJ1 CH1 Control output (heating) (1) H'00000002: EJ1 CH2 Control output (heating) (2) H'00000003: EJ1 CH3 Control output (heating) (3) H'00000004: EJ1 CH4 Control output (heating) (4) H'00000005: EJ1 CH1 Control output (cooling) (5) H'00000006: EJ1 CH2 Control output (cooling) (6) H'00000007: EJ1 CH3 Control output (cooling) (7) H'00000008: EJ1 CH4 Control output (cooling) (8)	0	---	NUM	●	---
		0185	F085	G3PW1-External Duty Input Enable/Disable	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	NUM	●	---
		0186	F086	G3PW1-Output Mode Selection	H' 00000000: Proportional to Phase Angle (for G3PX Compatibility) (0) H' 00000001: Proportional to Square Voltage (1) H' 00000002: Proportional to Voltage (2) H' 00000003: Constant Current (3)	0	---	NUM	●	---
		0187	F087	G3PW1-Input Digital Filter Time Constant	H' 00000000 to H' 000003E8 (0.0 to 100.0)	0.0	ms	NUM	●	---
		0188	F088	G3PW1-Input Signal Type	H' 00000000: Linear Input (0) H' 00000001: Voltage ON/OFF Input (1)	0	---	NUM	●	---
		0189	F089	G3PW1-Main Setting Automatic Input Selection	H' 00000000: 4 to 20 mA or 1 to 5 V (0) H' 00000001: Communications (1)	0	---	NUM	●	---
		018A	F08A	G3PW1-Main Setting Manual Input Selection	H' 00000000: External Adjuster Input (0) H' 00000001: Key Input (1)	0	---	NUM	●	---
		018B	F08B	G3PW1-Control Method Default	H' 00000000: Phase Control (0) H' 00000001: Optimum cycle control (1)	0	---	NUM	●	---
		018C	F08C	G3PW1-Main Setting Automatic/Manual Default	H' 00000000: Automatic (0) H' 00000001: Manual (1)	0	---	NUM	●	---
		018D	F08D	G3PW1-Number of Alarms for Heater Burnout Detection	H' 00000000 to H' 000003E7 (0 to 999)	150	Times	NUM	●	---
		018E	F08E	G3PW1-Load Current Upper Limit	H' 00000000 to H' 00000294 (0.0 to 66.0)	0.0	A	NUM	●	---
		018F	F08F	G3PW1-Event Input Assignment	H' 00000000: No Assignment (0) H' 00000001: Control Method Selection (1) H' 00000002: Main Setting Automatic/Manual Selection (2)	0	---	NUM	●	---
		0190	F090	G3PW1-Alarm Output Open in Alarm	H' 00000000: Close in alarm (0) H' 00000001: Open in alarm (1)	1	---	NUM	●	---
		0191	F091	G3PW1-Heater Burnout Alarm Operation	H' 00000000: Disable (0) H' 00000001: Alarm Level 1 (1) H' 00000002: Alarm Level 2 (2)	0	---	NUM	●	---
		0192	F092	G3PW1-Total Run Time Exceeded Alarm Operation	H' 00000000: Disable (0) H' 00000001: Alarm Level 1 (1) H' 00000002: Alarm Level 2 (2)	0	---	NUM	●	---
		0193	F093	G3PW1-Total Run Time Alarm Set Value	H' 00000000 to H' 000003E7 (0 to 99.9)	0.0	kh	NUM	●	---
		0194	F094	G3PW1-External Input Range Alarm Operation	H' 00000000: Disable (0) H' 00000001: Alarm Level 1 (1) H' 00000002: Alarm Level 2 (2)	0	---	NUM	●	---
		0195	F095	G3PW1-External Duty Input Alarm Operation	H' 00000000: Disable (0) H' 00000001: Alarm Level 1 (1) H' 00000002: Alarm Level 2 (2)	0	---	NUM	●	---
		Not used.								
		0200	F100	G3PW2 - Internal Duty Setting	The rest are the same as the G3PW1.					
		⋮	⋮	⋮						
		0300	F200	G3PW3 - Internal Duty Setting						
		⋮	⋮	⋮						
		0400	F300	G3PW4 - Internal Duty Setting						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
DA (9A) V1.1	Can be changed during operation.	⋮	⋮	⋮						
		0500	F400	G3PW5 - Internal Duty Setting						
		⋮	⋮	⋮						
		0600	F500	G3PW6 - Internal Duty Setting						
		⋮	⋮	⋮						
		0700	F600	G3PW7 - Internal Duty Setting						
		⋮	⋮	⋮						
		0800	F700	G3PW8 - Internal Duty Setting						
		⋮	⋮	⋮						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
E0 (A0)	Can be changed while stopped.	Not used.								
		0001	9200	Cold Junction Compensation Method	H' 00000000: Externally (0) H' 00000001: Internally (1)	1	---	Common	●	---
		Not used.								
		0100	0320	Input Type - CH1	H' 00000000: Pt100 (0) H' 00000001: Pt100 (1) H' 00000002: Pt100 (2) H' 00000003: JPt100 (3) H' 00000004: JPt100 (4) H' 00000005: K (5) H' 00000006: K (6) H' 00000007: J (7) H' 00000008: J (8) H' 00000009: T (9) H' 0000000A: T (10) H' 0000000B: E (11) H' 0000000C: L (12) H' 0000000D: U (13) H' 0000000E: U (14) H' 0000000F: N (15) H' 00000010: R (16) H' 00000011: S (17) H' 00000012: B (18) H' 00000013: W (19) H' 00000014: PLII (20) H' 00000015: 10 to 70°C (21) H' 00000016: 60 to 120°C (22) H' 00000017: 115 to 165°C (23) H' 00000018: 140 to 260°C (24) H' 00000019: 4 to 20 mA (25) H' 0000001A: 0 to 20 mA (26) H' 0000001B: 1 to 5 V (27) H' 0000001C: 0 to 5 V (28) H' 0000001D: 0 to 10 V (29) H' 0000001E: K V1.2 (30)	5	---	ch	●	---
		0101	0321	Temperature Unit - CH1	H' 00000000: °C (0) H' 00000001: °F (1)	0	---	ch	●	---
		0102	0322	Scaling Upper Limit - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	1000	---	ch	●	---
		0103	0323	Scaling Lower Limit - CH1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	---	ch	●	---
		0104	0324	Decimal Point Position - CH1	H' 00000000: **** (No decimal point) (0) H' 00000001: ***.* (1) H' 00000002: **.** (2) H' 00000003: *.*** (3)	1	---	ch	●	---
		Not used.								
		0200	0520	Input Type - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	0720	Input Type - CH3					TC4	---
		⋮	⋮	⋮						
		0400	0920	Input Type - CH4					TC4	---
		⋮	⋮	⋮						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
E1 (A1)	Can be changed while stopped.	0100	0340	Control Output 1 Assignment	H' 00000000: Disabled (0) H' 00000001: Temperature Controller error (1)	47	---	IO	●	---
					H' 00000002: All channels All alarm OR (2) H' 00000003: All channels All alarm AND (3) H' 00000004: All channels Alarm 1 OR (4) H' 00000005: All channels Alarm 2 OR (5) H' 00000006: All channels Alarm 3 OR (6) H' 00000007: All channels Alarm 1 AND (7) H' 00000008: All channels Alarm 2 AND (8) H' 00000009: All channels Alarm 3 AND (9) H' 0000000A: All channels Input error OR (10) H' 0000000B: All channels RSP Input error OR (11)				●	
					Not used.					
					H' 0000000D: All channels HB (Heater Burnout) alarm OR (13) H' 0000000E: All channels HS (Heater Short) alarm OR (14) H' 0000000F: All channels OC (Heater Overcurrent) alarm OR (15)					
					Not used.					
					H' 00000020: CH1 Alarm 1 (32) H' 00000021: CH1 Alarm 2 (33) H' 00000022: CH1 Alarm 3 (34) H' 00000023: CH1 All alarm OR (35) H' 00000024: CH1 All alarm AND (36) H' 00000025: CH1 Input error (37) H' 00000026: CH1 RSP Input error (38)					
					Not used.					
					H' 00000028: CH1 HB (Heater Burnout) alarm (40) H' 00000029: CH1 HS (Heater Short) alarm (41) H' 0000002A: CH1 OC (Heater Overcurrent) alarm (42) H' 0000002B: CH1 PV (43) H' 0000002C: CH1 SP (44) H' 0000002D: CH1 Local SP (45) H' 0000002E: CH1 Remote SP (46) H' 0000002F: CH1 Control output (heating) (47) H' 00000030: CH1 Control output (cooling) (48)					
					Not used.					
					H' 0000003A: ch1 Transfer Output (Heating) **V1.1** (58)				TC2	
					H' 0000003B: ch1 Transfer Output (Cooling) **V1.1** (59)					
					Not used.				●	
					H' 00000040: Channel 2: The same as channel 1. (64)					
					⋮					
					H' 00000060: Channel 3: The same as channel 1. (96)				TC4	
					⋮					
					H' 00000080: Channel 4: The same as channel 1. (128)					
					⋮					
		0101	0341	Control Period 1	H' 00000000 to H' 00000063 (0 to 99) (0.5 s period when set to 0.)	2	s	IO	●	---
		0102	0342	Linear Output 1 Type **V1.1**	H' 00000000: 4 to 20mA (0) H' 00000001: 0 to 20mA (1)	0	---	IO	TC2	---
		0103	0343	Output Scaling Upper Limit 1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	100	---	IO	●	---
		0104	0344	Output Scaling Lower Limit 1	H' FFFFF831 to H' 0000270F (–1999 to 9999)	0	---	IO	●	---
		0105	0345	Decimal Point C1	H' 00000000: **** (No decimal point) (0) H' 00000001: ***.* (1) H' 00000002: **.** (2) H' 00000003: *.*** (3)	0	---	IO	●	---
		0106	0346	Minimum output ON/OFF width 1 **V1.2**	H' 00000000 to H' 000001F4 (0.0 to 50.0)	1.0	%	IO	●	---
		Not used.								
		0200	0540	Control Output 2 Assignment	The rest are the same as from Control Output 1 Assignment to Decimal Point C1.	TC4: 79 TC2: 79				
		⋮	⋮	⋮						
		0300	0740	Control Output 3 Assignment		TC4: 111 TC2: 32				
		⋮	⋮	⋮						
		0400	0940	Control Output 4 Assignment		TC4: 143 TC2: 64				
		⋮	⋮	⋮						

Note Parameters with the following mark are supported only by version 1.1 Temperature Controllers: **V1.1**
Refer to *Functional Upgrades* on page xxvi for details on upgraded functionality.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
E3 (A3)	Can be changed while stopped.	Not used.								
		0100	0360	Alarm 1 Type - CH1	H' 00000000: Alarm function OFF (0) H' 00000001: Upper and lower limit alarm (1) H' 00000002: Upper limit alarm (2) H' 00000003: Lower limit alarm (3) H' 00000004: Upper and lower limit range alarm (4) H' 00000005: Upper and lower limit alarm with standby sequence (5) H' 00000006: Upper limit alarm with standby sequence (6) H' 00000007: Lower limit alarm with standby sequence (7) H' 00000008: Absolute value upper limit alarm (8) H' 00000009: Absolute value lower limit alarm (9) H' 0000000A: Absolute value upper limit alarm with standby sequence (10) H' 0000000B: Absolute value lower limit alarm with standby sequence (11) H' 0000000C: LBA (Loop Burnout Alarm) (12)	2	---	ch	●	---
		0101	0361	Alarm 1 Latch - CH1	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	ch	●	---
		0102	0362	Alarm 1 Hysteresis - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note.)	0.2	EU	ch	●	---
		0103	0363	Alarm 1 Open in Alarm - CH1	H' 00000000: Close in alarm (0) H' 00000001: Open in alarm (1)	0	---	ch	●	---
		0104	0364	Alarm 1 ON Delay - CH1	H' 00000000 to H' 000003E7 (0 to 999)	0	s	ch	●	---
		0105	0365	Alarm 1 OFF Delay - CH1	H' 00000000 to H' 000003E7 (0 to 999)	0	s	ch	●	---
		0106	0366	Alarm 1 SP Selection - CH1	H' 00000000: Ramp SP (0) H' 00000001: Target SP (1)	0	---	ch	●	---
		0107	0367	Alarm 2 Type - CH1	The rest are the same as Alarm 1.					
		⋮	⋮	⋮						
		010E	036E	Alarm 3 Type - CH1						
		⋮	⋮	⋮						
		0115	0375	LBA Detection Time - CH1	H' 00000000 to H' 0000270F (0 to 9999)	0	s	ch	●	---
		0116	0376	LBA Level - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note.)	8.0	EU	ch	●	---
		0117	0377	LBA Band - CH1	H' 00000000 to H' 0000270F (0.0 to 999.9) (See note.)	3.0	EU	ch	●	---
		Not used.								
		0200	0560	Alarm 1 Type - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮						
		0300	0760	Alarm 1 Type - CH3					TC4	---
		⋮	⋮	⋮						
		0400	0960	Alarm 1 Type - CH4					TC4	---
		⋮	⋮	⋮						

Note The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
E4 (A4)	Can be changed while stopped.	0100	0380	CT1 Assignment	H' 00000000: Disabled (0) H' 00000001: Control output 1 (1) H' 00000002: Control output 2 (2) H' 00000003: Control output 3 (3) H' 00000004: Control output 4 (4)	1	---	IO	TC2	---
		0101	0381	Heater Burnout 1 Latch	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	IO	TC2	---
		0102	0382	Heater Burnout 1 Hysteresis	H' 00000001 to H' 000003E8 (0.1 to 100.0)	0.1	A	IO	TC2	---
		0103	0383	HS Alarm 1 Latch	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	IO	TC2	---
		0104	0384	HS Alarm 1 Hysteresis	H' 00000001 to H' 000003E8 (0.1 to 100.0)	0.1	A	IO	TC2	---
		0105	0385	Heater Overcurrent 1 Latch	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	IO	TC2	---
		0106	0386	Heater Overcurrent 1 Hysteresis	H' 00000001 to H' 000003E8 (0.1 to 100.0)	0.1	A	IO	TC2	---
		Not used.								
		0200	0580	CT2 Assignment	The rest are the same as from CT1 Assignment to Heater Overcurrent 1 Hysteresis.	2				
		⋮	⋮	⋮						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
E5 (A5)	Can be changed while stopped.	0000	9280	AT Calculated Gain	H' 00000001 to H' 00000064 (0.1 to 10.0)	0.8	---	Common	●	---
		0001	9281	Limit Cycle MV Amplitude	H' 00000032 to H' 000001F4 (5.0 to 50.0)	20.0	%	Common	●	---
		0002	9282	Disturbance Overshoot Adjustment Function	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	Common	●	---
		Not used.								
		0100	03A0	Direct/Reverse Operation - CH1	H' 00000000: Reverse operation (0) H' 00000001: Direct operation (1)	0	---	ch	●	---
		0101	03A1	SP Ramp Time Unit - CH1	H' 00000000: Seconds (0) H' 00000001: Minutes (1)	1	---	ch	●	---
		0102	03A2	AT Hysteresis - CH1	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note.)	0.8	EU	ch	●	---
		0103	03A3	Temporary AT Execution Judgement Deviation - CH1	H' 00000000 to H' 0000270F (0.1 to 999.9) (See note.)	150.0	EU	ch	●	---
		Not used.								
		0105	03A5	RT - CH1	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	ch	●	---
		0106	03A6	PID/OnOff - CH1	H' 00000000: 2-PID control (0) H' 00000001: ON-OFF control (1)	0	---	ch	●	---
		0107	03A7	Output Mode Selection - CH1	H' 00000000: Standard control (0) H' 00000001: Heating/cooling control(1)	0	---	ch	●	---
		0108	03A8	SP Tracking - CH1	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	ch	●	---
		Not used.								
		010C	03AC	ST - CH1 **V1.2**	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	ch	●	---
		010D	03AD	ST Stable - CH1 **V1.2**	H' 00000001 to H' 0000270F (0.1 to 999.9) (See note.)	15.0	EU	ch	●	---
		010E	03AE	Independent heating/cooling PID method - CH1 **V1.2**	H' 00000000: Disabled (0) H' 00000001: Air cooling (1) H' 00000002: Water cooling (2) H' 00000003: Linear (3)	0	---	ch	●	---
		Not used.								
		0200	05A0	Direct/Reverse Operation - CH2	The rest are the same as channel 1.					
		⋮	⋮	⋮	Note: The SP Tracking - CH2 parameter is supported only by the TC4.					
		0300	07A0	Direct/Reverse Operation - CH3	Note: The SP Tracking - CH3 parameter cannot be used.				TC4	---
		⋮	⋮	⋮						
		0400	09A0	Direct/Reverse Operation - CH4	Note: The SP Tracking - CH4 parameter cannot be used.				TC4	---
		⋮	⋮	⋮						

Note The decimal point position is determined by the sensor selection. In this case, however, the 0 (****) decimal point position setting will be treated as a setting of 1 (***.*).

Variable type	CompoWay/F Category	CompoWay/F Address	Modbus Address	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit TC4/TC2	Target Unit HFU
F0 (B0)	Enabled after resetting.	0000	A200	Remote SP Enable	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	Common	●	---
		0001	A201	Operation After Power ON	H' 00000000: Continue (0) H' 00000001: Stop (1) H' 00000002: Manual mode (2)	0	---	Common	●	---
		Not used.								
		0003	A203	Operation During Error (Selection B)	H' 00000000: Notification only (Continue) (0) H' 00000001: MV at PV error (1) H' 00000002: Control Stop (2)	0	---	Common	●	---
		Not used.								
		0020	A220	Port B Communications Protocol **V1.1**	H' 00000000: CompoWay/F (0) H' 00000001: Modbus (1)	0	---	Common	●	●
		0021	A221	Port B Communications Baud Rate (TC4/TC2)	Not used.	3	---	Common	●	●
				Port C Communications Baud Rate (HFU)	H' 00000003: 9.6 (3) H' 00000004: 19.2 (4) H' 00000005: 38.4 (5) H' 00000006: 57.6 (6) H' 00000007: 115.2 (7) (kbps)	7				
		0022	A222	Port B Communications Data Length (TC4/TC2)	H' 00000000: 7 (0) H' 00000001: 8 (1)(bit)	0	---	Common	●	●
				Port C Communications Data Length (HFU)		1				
		0023	A223	Port B Communications Parity (TC4/TC2)	H' 00000000: None (0) H' 00000001: Even (1) H' 00000002: Odd (2)	1	---	Common	●	●
				Port C Communications Parity (HFU)		1				
		0024	A224	Port B Communications Stop Bits (TC4/TC2)	H' 00000000: 1 (0) H' 00000001: 2 (1)(bit)	1	---	Common	●	●
				Port C Communications Stop Bits (HFU)		0				
		0025	A225	Port B Send Wait Time (TC4/TC2)	H' 00000000 to H' 00000063 (0 to 99)	5	ms	Common	●	●
				Port C Send Wait Time (HFU)		5				
		0026	A226	Port A Communications Send Wait Time	H' 00000001 to H' 00000063 (1 to 99)	1	ms	Common	●	●
		Not used.								
		0029	A229	Proportional Band x10 Compensation	H' 00000000: Disabled (0) H' 00000001: Enabled (1)	0	---	Common	●	---
		0030	A230	Programless Communications Protocol	Not used.	2	---	Common	---	●
					H' 00000002: NT Link (1: N) (2)					
					Not used.					
					H' 00000004: AnA/AnU CPU common commands **V1.1** (4) H' 00000005: MC protocol (format 5) (5)					
		0031	A231	Programless Communications Upload Data Area NT Link (1: N)	H' 00000000: DM (0) H' 00000001: EM0 (1) H' 00000002: EM1 (2) H' 00000003: EM2 (3) H' 00000004: EM3 (4) H' 00000005: EM4 (5) H' 00000006: EM5 (6) H' 00000007: EM6 (7) H' 00000008: EM7 (8) H' 00000009: EM8 (9) H' 0000000A: EM9 (10) H' 0000000B: EMA (11) H' 0000000C: EMB (12) H' 0000000D: EMC (13)	0	---	Common	---	●
				MC protocol (format 5)	H' 00000000: Data register (D) (0) H' 00000001: Link register (W) (1) H' 00000002: File register (R) (2)	0				
		0032	A232	Programless Communications Download Data Area NT Link (1: N)	H' 00000000: DM (0) H' 00000001: EM0 (1) H' 00000002: EM1 (2) H' 00000003: EM2 (3) H' 00000004: EM3 (4) H' 00000005: EM4 (5) H' 00000006: EM5 (6) H' 00000007: EM6 (7) H' 00000008: EM7 (8) H' 00000009: EM8 (9) H' 0000000A: EM9 (10) H' 0000000B: EMA (11) H' 0000000C: EMB (12) H' 0000000D: EMC (13)	0	---	Common	---	●
				MC protocol (format 5)	H' 00000000: Data register (D) (0) H' 00000001: Link register (W) (1) H' 00000002: File register (R) (2)	0				
		0033	A233	Programless Communications Upload Start Address	H' 00000000 to H' 00007FFF (0 to 32767)	0	---	Common	---	●
		0034	A234	Programless Communications Download Start Address	H' 00000000 to H' 00007FFF (0 to 32767)	500 1000 1500	--- **V1.1** **V1.2**	Common	---	●
		0035	A235	Programless Communications Receive Wait Time (See note 1.)	H' 0000000A to H' 00002710 (10 to 10000)	2000	ms	Common	---	●
		0036	A236	Programless Communications Node Address (See note 1.)	H' 00000000 to H' 00000063 (0 to 99)	0	---	Common	---	●
		0037	A237	Programless Communications Maximum Communications Unit Number **V1.1**	H' 00000000 to H' 0000003F (0 to 63)	0	---	Common	---	●
		0038	A238	Selection of Programless Communications Operation during Error **V1.1**	H' 00000000: Continue (0) H' 00000001: Stop (1)	1	---	Common	---	●

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
F0 (B0)	Enabled after resetting.	0040	A240	Output ON Scheduling Method	H' 00000000: No control (0) H' 00000001: 1/2 (1)	0	---	Common	●	---
					H' 00000002: 1/4 (2)				TC4	---
		Not used.								
		0042	A242	Delay Between Output Channels (See note 2.)	H' 00000000 to H' 000003E8 (0 to 1000)	10	ms	Common	●	---

Note (1) Not valid when an NT Link is being used.

(2) Set the Delay between Outputs parameter to an even number. If an odd number is set, the next smaller even number will be used.

(3) Parameters with the following mark are supported only by version 1.1 Temperature Controllers: **V1.1**
Refer to *Functional Upgrades* on page xxvi for details on upgraded functionality.

(4) **V1.2** ... Can only be used by improved models.
For details on improved models, refer to *Functional Upgrades* on page xxiv.

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
F2 (B2)	Enabled after resetting.	0000	A400	Event Input 1 Assignment	H' 00000000: Disabled (0) H' 00000001: All channels Bank (bit0) (1) H' 00000002: All channels Bank (bit1) (2) H' 00000003: All channels Stop (0)/Run (1) (3) H' 00000004: All channels Run (0)/Stop (1) (4) H' 00000005: All channels Auto (0)/Manual (1) (5) H' 00000006: All channels SP mode (Local (0)/Remote (1)) (6)	0	---	Common	TC2	---
					Not used.					
					H' 00000020: CH1 Bank (bit0) (32) H' 00000021: CH1 Bank (bit1) (33) H' 00000022: CH1 Stop (0)/Run (1) (34) H' 00000023: CH1 Run (0)/Stop (1) (35) H' 00000024: CH1 Auto (0)/Manual (1) (36) H' 00000025: CH1 SP mode (Local (0)/Remote (1)) (37)					
					Not used.					
					H' 00000040: The rest are the same as channel 1. (64)					
					⋮					
		0001	A401	Event Input 2 Assignment	The rest are the same as Event Input 1 Assignment.					
		Not used.								
		0010	A410	Auxiliary Output 1 Assignment	H' 00000000: Disabled (0) H' 00000001: Temperature Controller error (1)	20	---	Common	---	●
					Not used.					
					H' 00000010: Event input 1 (16) H' 00000011: Event input 2 (17) H' 00000012: Event input 3 (18) H' 00000013: Event input 4 (19) H' 00000014: Bus input 1 (20) H' 00000015: Bus input 2 (21) H' 00000016: Bus input 3 (22)					
		0011	A411	Auxiliary Output 2 Assignment	The rest are the same as Auxiliary Output 1 Assignment.	21				
		0012	A412	Auxiliary Output 3 Assignment		22				
		0013	A413	Auxiliary Output 4 Assignment		0				
		Not used.								
		0020	A420	Bus Input 1 Assignment	H' 00000000: Disabled (0) H' 00000001: All channels Bank (bit0) (1) H' 00000002: All channels Bank (bit1) (2) H' 00000003: All channels Stop (0)/Run (1) (3) H' 00000004: All channels Run (0)/Stop (1) (4) H' 00000005: All channels Auto (0)/Manual (1) (5) H' 00000006: All channels SP mode (Local (0)/Remote (1)) (6)	0	---	Common	●	---
					Not used.					
					H' 00000020: CH1 Bank (bit0) (32) H' 00000021: CH1 Bank (bit1) (33) H' 00000022: CH1 Stop (0)/Run (1) (34) H' 00000023: CH1 Run (0)/Stop (1) (35) H' 00000024: CH1 Auto (0)/Manual (1) (36) H' 00000025: CH1 SP mode (Local (0)/Remote (1)) (37)					
					Not used.					
					H' 00000040: Channel 2: The same as channel 1. (64)					
					⋮					
					H' 00000060: Channel 3: The same as channel 1. (96)				TC4	---
					⋮					
					H' 00000080: Channel 4: The same as channel 1. (128)					
					⋮					
		0021	A421	Bus Input 2 Assignment	The rest are the same as Bus Input 1 Assignment.					
		0022	A422	Bus Input 3 Assignment						

Variable type	CompoWay/F		Modbus	Parameter name	Setting (monitor) range	Default	Unit	Attributes	Target Unit	
	Category	Address	Address						TC4/TC2	HFU
F2 (B2)	Enabled after resetting.	Not used.								
		0030	A430	Bus Output 1 Assignment	H' 00000000: Disabled (0) H' 00000001: Temperature Controller error (1)	TC4: 4 HFU: 0	---	Common	●	●
					H' 00000002: All channels All alarm OR (2) H' 00000003: All channels All alarm AND (3) H' 00000004: All channels Alarm 1 OR (4) H' 00000005: All channels Alarm 2 OR (5) H' 00000006: All channels Alarm 3 OR (6) H' 00000007: All channels Alarm 1 AND (7) H' 00000008: All channels Alarm 2 AND (8) H' 00000009: All channels Alarm 3 AND (9) H' 0000000A: All channels Input error OR (10) H' 0000000B: All channels RSP Input error OR (11)					---
					Not used.					
					H' 0000000D: All channels HB (Heater Burnout) alarm OR (13) H' 0000000E: All channels HS (Heater Short) alarm OR (14) H' 0000000F: All channels OC (Heater Overcurrent) alarm OR (15)					
					H' 00000010: Event input 1 (16) H' 00000011: Event input 2 (17)				TC2	●
					H' 00000012: Event input 3 (18) H' 00000013: Event input 4 (19)				---	
					H' 00000014: Bus input 1 (20) H' 00000015: Bus input 2 (21) H' 00000016: Bus input 3 (22)				●	
					Not used.					
					H' 00000020: CH1 Alarm 1 (32) H' 00000021: CH1 Alarm 2 (33) H' 00000022: CH1 Alarm 3 (34) H' 00000023: CH1 All alarm OR (35) H' 00000024: CH1 All alarm AND (36) H' 00000025: CH1 Input error (37) H' 00000026: CH1 RSP Input error (38)					---
					Not used.					
					H' 00000028: CH1 HB (Heater Burnout) alarm (40) H' 00000029: CH1 HS (Heater Short) alarm (41) H' 0000002A: CH1 OC (Heater Overcurrent) alarm (42)					
					Not used.					
					H' 00000032: CH1 Bank (bit0) (50) H' 00000033: CH1 Bank (bit1) (51) H' 00000034: CH1 Stop (0)/Run (1) (52) H' 00000035: CH1 Run (0)/Stop (1) (53) H' 00000036: CH1 Auto (0)/Manual (1) (54) H' 00000037: CH1 SP mode (Local (0)/Remote (1)) (55)					
					Not used.					
					H' 00000040: Channel 2: The same as channel 1. (64)					
					⋮					
					H' 00000060: Channel 3: The same as channel 1. (96)				TC4	
					⋮					
					H' 00000080: Channel 4: The same as channel 1. (128)					
					⋮					
		0031	A431	Bus Output 2 Assignment	The rest are the same as Bus Output 1 Assignment.	TC: 5 HFU: 0				
		0032	A432	Bus Output 3 Assignment		TC: 6 HFU: 0				

Status Lists

Use the Status listed in the following tables to check EJ1 status.

TC4/TC2

C0 Status

C0/80 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Heater Overcurrent V1.2 (See note 1.)	No error	Error	The heater current value exceeds 110.0 A.
Bit 1	Heater Current Hold V1.2 (See note 1.)	Updated	Hold	The heater current monitor has not been updated because the control output ON time is less than 100 ms.
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Input error	No error	Error	An input error has occurred.
Bit 7	Not used.			
Bit 8	Control output V1.2 (See note 2.)	OFF	ON	Control output status can be checked.
Bit 9	Control output V1.2 (See note 3.)	OFF	ON	Control output status can be checked.
Bit 10	HB alarm V1.2	OFF	ON	An alarm has occurred.
Bit 11	Not used.			
Bit 12	Alarm Output 1	OFF	ON	An alarm 1 error has occurred.
Bit 13	Alarm Output 2	OFF	ON	An alarm 2 error has occurred.
Bit 14	Alarm Output 3	OFF	ON	An alarm 3 error has occurred.
Bit 15	Not used.			
Bit 16	Event input 1 V1.2	OFF	ON	Event input 1 status can be checked.
Bit 17	Event input 2 V1.2	OFF	ON	Event input 2 status can be checked.
Bit 18	Not used.			
Bit 19	Not used.			
Bit 20	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 21	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 22	ST V1.2	ST is stopped.	ST is executing.	ST Execute/Stop status can be checked.
Bit 23	AT Execute/Cancel	AT is stopped	AT execution in progress	Can confirm AT Execute/Cancel.
Bit 24	RUN/STOP	Run	Stop	Run/stop can be confirmed.
Bit 25	Communications Writing	---	ON (enabled)	Communications Writing is always ON (enabled).
Bit 26	Auto/Manual	Auto	Manual	Auto/manual can be confirmed.
Bit 27	SP Mode	LSP	RSP	SP mode can be confirmed.
Bit 28	Not used.			
Bit 29	Not used.			
Bit 30	SP Ramp V1.2	OFF	Ramp is executing.	SP Ramp status can be checked.
Bit 31	Not used.			

Note (1) The values are displayed as follows: CT1 = channel 1 and CT2 = channel 2.

(2) The values are displayed as follows: OUT1 = channel 1, OUT2 = channel 2, OUT3 = channel 3, and OUT4 = channel 4.

(3) The status is displayed as follows: OUT3 = channel 3 and OUT 4 = channel 4.

Device A Status C4/84 0000

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Device Error	No error	Error	There is a memory error. Refer to *Device Error Status*.
Bit 1	Configuration Error	No error	Error	There is an error in the device configuration. Refer to *Configuration Error A Status*, and *Configuration Error B Status*.
Bit 2	Channel Error	No error	Error	There is an error in one of the channels. Refer to *Error Channel A Status*.
Bit 3	Not used.			
Bit 4	Expand Communications Error	No error	Error	There is an error in communications with the connected G3ZA. Refer to *Internal Communications Error Status*.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	I/O Error	No error	Error	There is an I/O error. Refer to *I/O Error Status*.
Bit 11	Lower-level I/O Error	No error	Error	There is an error in the connected G3ZA. Refer to *Basic Unit/Expand Unit Error Status*.
Bit 12	I/O Alarm	No error	Error	There is an I/O alarm. Refer to *I/O Alarm A Status* and *I/O Alarm B Status*.
Bit 13	Lower-level I/O Alarm	No error	Error	An alarm has occurred in the connected G3ZA. Refer to *Basic Unit/Expand Unit Alarm Status*.
Bit 14	I/O Notification	No error	Error	There is an I/O notification. Refer to *I/O Notification A Status*.
Bit 15	Not used.			

Note The above information also applies to the G3PW. **V1.1**

Device Error Status

C4/84 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	EEPROM Error	No error	Error	There is a memory error.
Bit 5	Calibration Error	No error	Error	There is a memory error.
Bit 6	Setting Value Error	No error	Error	There is a memory error.
Bit 7	Not used.			
Bit 8	Configured Registration Data Error	No error	Error	There is a memory error.
Bit 9	Model Information Data Error	No error	Error	There is a memory error.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Model Information Mismatching Error	No error	Error	There is a memory error.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Configuration Error A Status

C4/84 0002

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Undefined Expand Units	No error	Error	A Unit that is not recognized is connected.
Bit 1	Not used.			
Bit 2	Too Many Expand units	No error	Error	More than 9 G3ZA Units are connected.
Bit 3	Expand Unit Failure	No error	Error	There is an error in communications with the G3ZA.
Bit 4	Expand Unit Connection Fault	No error	Error	A communications response has not been received from a G3ZA after it was registered in the configuration.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note The above information also applies to the G3PW. **V1.1**

Configuration Error B Status

C4/84 0003

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Error	No error	Error	There is an error in communications with the G3ZA1.
Bit 1	Expand Unit 2 Error	No error	Error	There is an error in communications with the G3ZA2.
Bit 2	Expand Unit 3 Error	No error	Error	There is an error in communications with the G3ZA3.
Bit 3	Expand Unit 4 Error	No error	Error	There is an error in communications with the G3ZA4.
Bit 4	Expand Unit 5 Error	No error	Error	There is an error in communications with the G3ZA5.
Bit 5	Expand Unit 6 Error	No error	Error	There is an error in communications with the G3ZA6.
Bit 6	Expand Unit 7 Error	No error	Error	There is an error in communications with the G3ZA7.
Bit 7	Expand Unit 8 Error	No error	Error	There is an error in communications with the G3ZA8.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note The above information also applies to the G3PW. **V1.1**

Internal Communications Error Status

C4/84 0004

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Communications Error	No error	Error	There is an error in communications with the G3ZA1.
Bit 1	Expand Unit 2 Communications Error	No error	Error	There is an error in communications with the G3ZA2.
Bit 2	Expand Unit 3 Communications Error	No error	Error	There is an error in communications with the G3ZA3.
Bit 3	Expand Unit 4 Communications Error	No error	Error	There is an error in communications with the G3ZA4.
Bit 4	Expand Unit 5 Communications Error	No error	Error	There is an error in communications with the G3ZA5.
Bit 5	Expand Unit 6 Communications Error	No error	Error	There is an error in communications with the G3ZA6.
Bit 6	Expand Unit 7 Communications Error	No error	Error	There is an error in communications with the G3ZA7.
Bit 7	Expand Unit 8 Communications Error	No error	Error	There is an error in communications with the G3ZA8.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note The above information also applies to the G3PW. **V1.1**

I/O Error Status

C4/84 0005

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Main Input 1 Count Error	No error	Error	There is a channel 1 input error.
Bit 1	Main Input 2 Count Error	No error	Error	There is a channel 2 input error.
Bit 2	Main Input 3 Count Error	No error	Error	There is a channel 3 input error.
Bit 3	Main Input 4 Count Error	No error	Error	There is a channel 4 input error.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Alarm A Status

C4/84 0006

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CT1 Heater Overcurrent	No error	Error	The heater current 1 value exceeds 110.0 A.
Bit 1	CT2 Heater Overcurrent	No error	Error	The heater current 2 value exceeds 110.0 A.
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Alarm B Status

C4/84 0007

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CT1 HB Alarm	OFF	ON	An HB alarm has occurred for CT1 input.
Bit 1	CT1 HS Alarm	OFF	ON	An HS alarm has occurred for CT1 input.
Bit 2	CT1 OC Alarm	OFF	ON	An OC alarm has occurred for CT1 input.
Bit 3	Not used.			
Bit 4	CT2 HB Alarm	OFF	ON	An HB alarm has occurred for CT2 input.
Bit 5	CT2 HS Alarm	OFF	ON	An HS alarm has occurred for CT2 input.
Bit 6	CT2 OC Alarm	OFF	ON	An OC alarm has occurred for CT2 input.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

I/O Notification A Status

C4/84 0009

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CT1 Heater Current Hold	Updated	Hold	The heater current monitor has not been updated because the control output ON time is less than 100 ms. Will also hold when a CT is not connected.
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	CT2 Heater Current Hold	Updated	Hold	The heater current monitor has not been updated because the control output ON time is less than 100 ms. Will also hold when a CT is not connected.
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Error Channel A Status

C4/84 000B

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	CH1	No error	Error	Channel 1 has an error.
Bit 1	CH2	No error	Error	Channel 2 has an error.
Bit 2	CH3	No error	Error	Channel 3 has an error.
Bit 3	CH4	No error	Error	Channel 4 has an error.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Basic Unit/Expand Unit Error Status

C4/84 000F

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Error	No error	Error	The G3ZA1 has generated a zero cross error.
Bit 1	Expand Unit 2 Error	No error	Error	The G3ZA2 has generated a zero cross error.
Bit 2	Expand Unit 3 Error	No error	Error	The G3ZA3 has generated a zero cross error.
Bit 3	Expand Unit 4 Error	No error	Error	The G3ZA4 has generated a zero cross error.
Bit 4	Expand Unit 5 Error	No error	Error	The G3ZA5 has generated a zero cross error.
Bit 5	Expand Unit 6 Error	No error	Error	The G3ZA6 has generated a zero cross error.
Bit 6	Expand Unit 7 Error	No error	Error	The G3ZA7 has generated a zero cross error.
Bit 7	Expand Unit 8 Error	No error	Error	The G3ZA8 has generated a zero cross error.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note The above information also applies to the G3PW. A frequency error will also cause the current to be held.

Basic Unit/Expand Unit Alarm Status

C4/84 0010

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Expand Unit 1 Alarm	OFF	ON	The G3ZA1 has a heater burnout, overcurrent, or SSR short circuit.
Bit 1	Expand Unit 2 Alarm	OFF	ON	The G3ZA2 has a heater burnout, overcurrent, or SSR short circuit.
Bit 2	Expand Unit 3 Alarm	OFF	ON	The G3ZA3 has a heater burnout, overcurrent, or SSR short circuit.
Bit 3	Expand Unit 4 Alarm	OFF	ON	The G3ZA4 has a heater burnout, overcurrent, or SSR short circuit.
Bit 4	Expand Unit 5 Alarm	OFF	ON	The G3ZA5 has a heater burnout, overcurrent, or SSR short circuit.
Bit 5	Expand Unit 6 Alarm	OFF	ON	The G3ZA6 has a heater burnout, overcurrent, or SSR short circuit.
Bit 6	Expand Unit 7 Alarm	OFF	ON	The G3ZA7 has a heater burnout, overcurrent, or SSR short circuit.
Bit 7	Expand Unit 8 Alarm	OFF	ON	The G3ZA8 has a heater burnout, overcurrent, or SSR short circuit.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note The above information also applies to the G3PW. This alarm will also be caused by an SSR open failure. **V1.1**

Output Status

C4/84 0012

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Control Output 1 (See note.)	OFF	ON	The control output 1 status can be checked.
Bit 1	Control Output 2 (See note.)	OFF	ON	The control output 2 status can be checked.
Bit 2	Control Output 3	OFF	ON	The control output 3 status can be checked.
Bit 3	Control Output 4	OFF	ON	The control output 4 status can be checked.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Note Not supported by Temperature Controllers with linear outputs.

Device B Status

C4/84 0013

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Save RAM 1	No error	Error	Power was turned OFF while saving RAM1 and not all data was registered.
Bit 1	Save RAM 2	No error	Error	Power was turned OFF while saving RAM2 and not all data was registered.
Bit 2	Save Control Parameters	No error	Error	Power was turned OFF during parameter registration after autotuning was completed, and not all data was registered.
Bit 3	Registration of unit configuration/Registration of multiple reads	No error	Error	Power was turned OFF during Unit configuration registration or composite read registration and not all data was registered.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 9	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Configuration Registered	Not registered	Registered	Configuration registration status can be confirmed.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Channel Status

C4/84 0101 (CH1)·0201 (CH2)·0301 (CH3)·0401 (CH4)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	RUN/STOP	Run	Stop	Run/Stop can be confirmed.
Bit 1	Auto/Manual	Auto	Manual	Auto/Manual can be confirmed.
Bit 2	AT Execute/Cancel	AT is stopped	AT execution in progress	Can confirm AT Execute/Cancel.
Bit 3	SP Mode	LSP	RSP	SP mode can be confirmed.
Bit 4	ST **V1.2**	ST is stopped	ST is executing	ST Execute/Stop status can be checked.
Bit 5	SP Ramp **V1.2**	OFF	Ramp is executing.	SP Ramp status can be checked.
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Input Error	No error	Error	An input error has occurred.
Bit 9	RSP Input Error	No error	Error	An RSP input error has occurred.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Channel Alarm Status

C4/84 0102 (CH1)·0202 (CH2)·0302 (CH3)·0402 (CH4)

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Alarm 1	OFF	ON	An alarm 1 error has occurred.
Bit 1	Alarm 2	OFF	ON	An alarm 2 error has occurred.
Bit 2	Alarm 3	OFF	ON	An alarm 3 error has occurred.
Bit 3	Not used.			
Bit 4	Heater Overcurrent	No error	Error	A heater overcurrent has occurred.
Bit 5	HB Alarm	OFF	ON	An HB alarm has occurred.
Bit 6	HS Alarm	OFF	ON	An HS alarm has occurred.
Bit 7	OC Alarm	OFF	ON	An OC alarm has occurred.
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Set Point Limiter Out of Range	No error	Error	The set point is outside the set point limiter range.
Bit 13	Set Value Limiter Reverse Operation	No error	Error	The upper and lower set point limits are reversed.
Bit 14	MV Limiter Reverse Operation	No error	Error	The upper and lower MV limits are reversed.
Bit 15	Scaling Reverse Operation	No error	Error	The upper and lower scaling limits are reversed.

HFU

C0 Status

C0/80 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			
Bit 16	Not used.			
Bit 17	Not used.			
Bit 18	Not used.			
Bit 19	Not used.			
Bit 20	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 21	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 22	Not used.			
Bit 23	Not used.			
Bit 24	Not used.			
Bit 25	Communications Writing	---	ON (enabled)	Communications Writing is always ON (enabled).
Bit26	Not used.			
Bit 27	Not used.			
Bit 28	Not used.			
Bit 29	Not used.			
Bit 30	Not used.			
Bit 31	Not used.			

Device A Status

C4/84 0000

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Device Error	No error	Error	There is a memory error. Refer to *Device Error Status*.
Bit 1	Configuration Error	No error	Error	There is an error in the device configuration. Refer to *Configuration Error A Status*.
Bit 2	Not used.			
Bit 3	External RAM Error at Operation	No error	Error	There is a memory error.
Bit 4	Internal Communications Error	No error	Error	There is a programless communications error. Set when one of the programless error status bits turns ON. The internal communications error status, however, is not set.
Bit 5	Not used.			
Bit 6	Programless Link Error	No error	Error	There is a programless communications error.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Device Error Status

C4/84 0001

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	EEPROM Error	No error	Error	There is a memory error.
Bit 5	Not used.			
Bit 6	Setting Value Error	No error	Error	There is a memory error.
Bit 7	Not used.			
Bit 8	Not used.			
Bit 9	Model Information Data Error	No error	Error	There is a memory error.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Model Information Mismatching Error	No error	Error	There is a memory error.
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Configuration Error A Status

C4/84 0002

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Not used.			
Bit 2	Not used.			
Bit 3	Not used.			
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Illegal Unit Arrangement	No error	Error	A Unit is connected to the left of the HFU.
Bit 9	Not used.			
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Device B Status

C4/84 0013

Bit position	Status	Bit description		Meaning
		0	1	
Bit 0	Not used.			
Bit 1	Save RAM 2	No error	Error	Power was turned OFF while saving RAM2 and not all data was registered.
Bit 2	Not used.			
Bit 3	Registration of unit configuration/Registration of multiple reads	No error	Error	Power was turned OFF during Unit configuration registration or composite read registration and not all data was registered.
Bit 4	Not used.			
Bit 5	Not used.			
Bit 6	Not used.			
Bit 7	Not used.			
Bit 8	Write Mode	Backup	RAM write	Write mode can be confirmed.
Bit 9	EEPROM	RAM = EEPROM	RAM ≠ EEPROM	Can confirm whether or not the setting is registered in EEPROM.
Bit 10	Not used.			
Bit 11	Not used.			
Bit 12	Not used.			
Bit 13	Not used.			
Bit 14	Not used.			
Bit 15	Not used.			

Parameters That Can Be Allocated for Programless Communications

The following table lists the parameters that can be allocated to programless communications.

Function	Parameter	Attribute	Upload	Download	Remarks
Status	Device A Status	Common	●	---	Monitoring only
	Device Error Status	Common	●	---	Monitoring only
	Configuration Error A Status	Common	●	---	Monitoring only
	Configuration Error B Status	Common	●	---	Monitoring only
	Internal Communications Error Status	Common	●	---	Monitoring only
	I/O Error Status	Common	●	---	Monitoring only
	I/O Alarm A Status	Common	●	---	Monitoring only
	I/O Alarm B Status	Common	●	---	Monitoring only
	I/O Notification A Status	Common	●	---	Monitoring only
	Error Channel A Status	Common	●	---	Monitoring only
	Basic Unit/Expand Unit Error	Common	●	---	Monitoring only
	Basic Unit/Expand Unit Alarm	Common	●	---	Monitoring only
	Output Status	Common	●	---	Monitoring only
	Device B Status	Common	●	---	Monitoring only
HB Alarm	Heater Current Value 1 Monitor	IO	●	---	Monitoring only
	Leakage Current Value 1 Monitor	IO	●	---	Monitoring only
	Heater Current Value 2 Monitor	IO	●	---	Monitoring only
	Leakage Current Value 2 Monitor	IO	●	---	Monitoring only
	Heater Burnout 1 Detection	IO	●	●	
	HS Alarm 1	IO	●	●	
	Heater Overcurrent 1 Detection	IO	●	●	
	Heater Burnout 2 Detection	IO	●	●	
	HS Alarm 2	IO	●	●	
	Heater Overcurrent 2 Detection	IO	●	●	
Monitoring	Process Value	CH	●	---	Monitoring only
	Channel Status	CH	●	---	Monitoring only
	Channel Alarm Status	CH	●	---	Monitoring only
	Internal SP	CH	●	---	Monitoring only
	Local SP Monitor	CH	●	---	Monitoring only
	Remote SP Monitor	CH	●	---	Monitoring only
	Bank No. Monitor	CH	●	---	Monitoring only
	MV Monitor (Heating)	CH	●	---	Monitoring only
	MV Monitor (Cooling)	CH	●	---	Monitoring only
	Decimal Point Monitor	CH	●	---	Monitoring only
Target value	Present Bank Set Point	BANK	●	●	
	Present Bank SP Ramp Rise Value	BANK	●	●	
	Present Bank SP Ramp Fall Value	BANK	●	●	
	SP Upper Limit	CH	●	●	
	SP Lower Limit	CH	●	●	
Alarms	Present Bank Alarm Value 1	BANK	●	●	
	Present Bank Alarm Upper Limit Value 1	BANK	●	●	
	Present Bank Alarm Lower Limit Value 1	BANK	●	●	
	Present Bank Alarm Value 2	BANK	●	●	
	Present Bank Alarm Upper Limit Value 2	BANK	●	●	
	Present Bank Alarm Lower Limit Value 2	BANK	●	●	
	Present Bank Alarm Value 3	BANK	●	●	
	Present Bank Alarm Upper Limit Value 3	BANK	●	●	
	Present Bank Alarm Lower Limit Value 3	BANK	●	●	
Inputs	Input Digital Filter	CH	●	●	
	Input Value 1 for Input Correction	CH	●	●	
	Input Shift 1	CH	●	●	
	Input Value 2 for Input Correction	CH	●	●	
	Input Shift 2	CH	●	●	

Function	Parameter	Attribute	Upload	Download	Remarks
Control	Present Bank Proportional Band	BANK	●	●	
	Present Bank Integral Time	BANK	●	●	
	Present Bank Derivative Time	BANK	●	●	
	Present Bank Manual Reset Value	BANK	●	●	
	Present Bank Cooling Coefficient	BANK	●	●	
	Present Bank Dead Band	BANK	●	●	
	Present Bank Proportional Band (Cooling) V1.2	BANK	●	●	
	Present Bank Integral Time (Cooling) V1.2	BANK	●	●	
	Present Bank Derivative Time (Cooling) V1.2	BANK	●	●	
	MV at PV Error	CH	●	●	
	MV at Stop	CH	●	●	
	MV Upper Limit	CH	●	●	
	MV Lower Limit	CH	●	●	
	Hysteresis (Heating)	CH	●	●	
	Hysteresis (Cooling)	CH	●	●	
	Alpha	CH	●	●	
	Manual MV	CH	●	●	
	Disturbance Gain	CH	●	●	
	Disturbance Time Constant	CH	●	●	
	Disturbance Rectification Band	CH	●	●	
	Disturbance Judgment Width	CH	●	●	
G3ZA V1.2 (See note 2.)	CH1 Control Variable Monitor	NUM	●	---	
	CH2 Control Variable Monitor	NUM	●	---	
	CH3 Control Variable Monitor	NUM	●	---	
	CH4 Control Variable Monitor	NUM	●	---	
	CH5 Control Variable Monitor	NUM	●	---	
	CH6 Control Variable Monitor	NUM	●	---	
	CH7 Control Variable Monitor	NUM	●	---	
	CH8 Control Variable Monitor	NUM	●	---	
	CH1 Status	NUM	●	---	
	CH2 Status	NUM	●	---	
	CH3 Status	NUM	●	---	
	CH4 Status	NUM	●	---	
	CH5 Status	NUM	●	---	
	CH6 Status	NUM	●	---	
	CH7 Status	NUM	●	---	
	CH8 Status	NUM	●	---	
	CH1 Heater ON Current Monitor	NUM	●	---	
	CH2 Heater ON Current Monitor	NUM	●	---	
	CH3 Heater ON Current Monitor	NUM	●	---	
	CH4 Heater ON Current Monitor	NUM	●	---	
	CH1 Heater OFF Current Monitor	NUM	●	---	
	CH2 Heater OFF Current Monitor	NUM	●	---	
	CH3 Heater OFF Current Monitor	NUM	●	---	
	CH4Heater OFF Current Monitor	NUM	●	---	
G3PW V1.1 (See note 3.)	Output Monitor	NUM	●	---	
	Status	NUM	●	---	
	Current Monitor	NUM	●	---	
Other (See note 4.)	Not used.	Common	●	●	For address adjustment only
	End code	Common	●	●	
	Error status 1	---	●	--- (See note.)	Monitoring only
	Error status 2	---	●	--- (See note.)	Monitoring only
	RUN/STOP (TC2: No. 00 to 07) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC2: No. 08 to 15) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC2: No. 16 to 23) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC2: No. 24 to 31) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC2: No. 00 to 07) V1.2	---	---	●	Only for operation commands

Function	Parameter	Attribute	Upload	Download	Remarks
Others (See note 4.)	AT Execute/Cancel (TC2: No. 08 to 15) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC2: No. 16 to 23) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC2: No. 24 to 31) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC2: No. 00 to 07) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC2: No. 08 to 15) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC2: No. 16 to 23) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC2: No. 24 to 31) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 00 to 03) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 04 to 07) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 08 to 11) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 12 to 15) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 16 to 19) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 20 to 23) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 24 to 27) V1.2	---	---	●	Only for operation commands
	RUN/STOP (TC4: No. 28 to 31) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 00 to 03) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 04 to 07) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 08 to 11) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 12 to 15) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 16 to 19) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 20 to 23) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 24 to 27) V1.2	---	---	●	Only for operation commands
	AT Execute/Cancel (TC4: No. 28 to 31) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 00 to 03) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 04 to 07) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 08 to 11) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 12 to 15) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 16 to 19) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 20 to 23) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 24 to 27) V1.2	---	---	●	Only for operation commands
	Auto/Manual (TC4: No. 28 to 31) V1.2	---	---	●	Only for operation commands

Note (1) ●: Can be allocated.---: Cannot be allocated.

(2) Only parameters G3ZA1 to G3ZA4 can be allocated.

(3) The only parameters that can be allocated as G3PW 1 to 4.

(4) The only parameters that can be allocated to the HFU are listed under *Other*. Parameters not listed under *Other* cannot be allocated.

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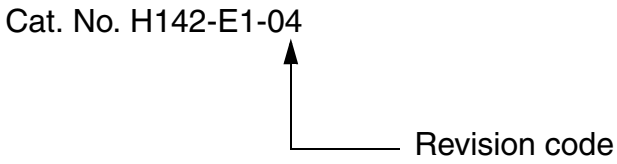
Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	February 2006	Original production
02	February 2007	Revised for addition of version 1.1 EJ1 Temperature Controllers and version 2 G3ZA Power Controllers.
02A	March 2007	Internal block diagram for TC4 corrected and parameter tables revised (Modbus addresses added and mistakes corrected).
02B	March 2007	Corrections made, including the following. **Page 118:** Changed the data register value from D1000 to D1001 for the Setting Change Request Bits in Monitoring EJ1 Set Values. **Page 122:** Added the baud rate for port C.
03	July 2008	Revised for addition of version 1.2 functions. Basic Units (TC4/TC2): • Autotuning is provided for heating/cooling control. • Self-tuning has been added. • Output status can be displayed on the operation indicators. • Modbus communications can be used to read and write all parameters, and to executed any of the operation commands. • A switch setting can be changed to use Modbus communications on port B. • Parameters and status have been improved. • Support has been added for G3PW Power Controllers. Advanced Unit (HFU): • Bit specification operation commands have been added. This simplifies programming ladder diagrams. • G3ZA monitor parameters have been added. • The maximum number of parameters that can be specified for programless setting has been increased to 1,200. • Communications unit numbers 32 to 39 can be used in the HFU via programless communications. This makes it easy to copy HFU and TC settings to other HFUs and TCs.

Revision code	Date	Revised content
04	February 2010	**Page 32:** Deleted restriction on directly connecting an HFU to EDU. **Page 73:** Added restriction for SP ramp operation **Page 89:** Corrected mistake in alarm delay description. **Page 105:** Added note on event inputs (TC2). **Page 106:** Added note on internal buses (TC4/TC2). **Page 118:** Corrected RS-485 wiring diagram. **Page 122:** Added countermeasure for communications noise resistance for RS-422 communications. **Page 131:** Corrected description of error status. **Page 153:** Added note on resetting HFU using operation command. **Page 157:** Corrected wiring diagram for 1:N connections to HFU. **Page 182:** Corrected mistake in related status for Controller Status Read. **Page 246:** Corrected defaults for G3PW1-Internal Duty Setting, G3PW1-External Input Range Alarm Operation, and G3PW1-External Duty Input Alarm Operation. **Page 264:** Corrected mistake in description of bit 5 in Channel Status.

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